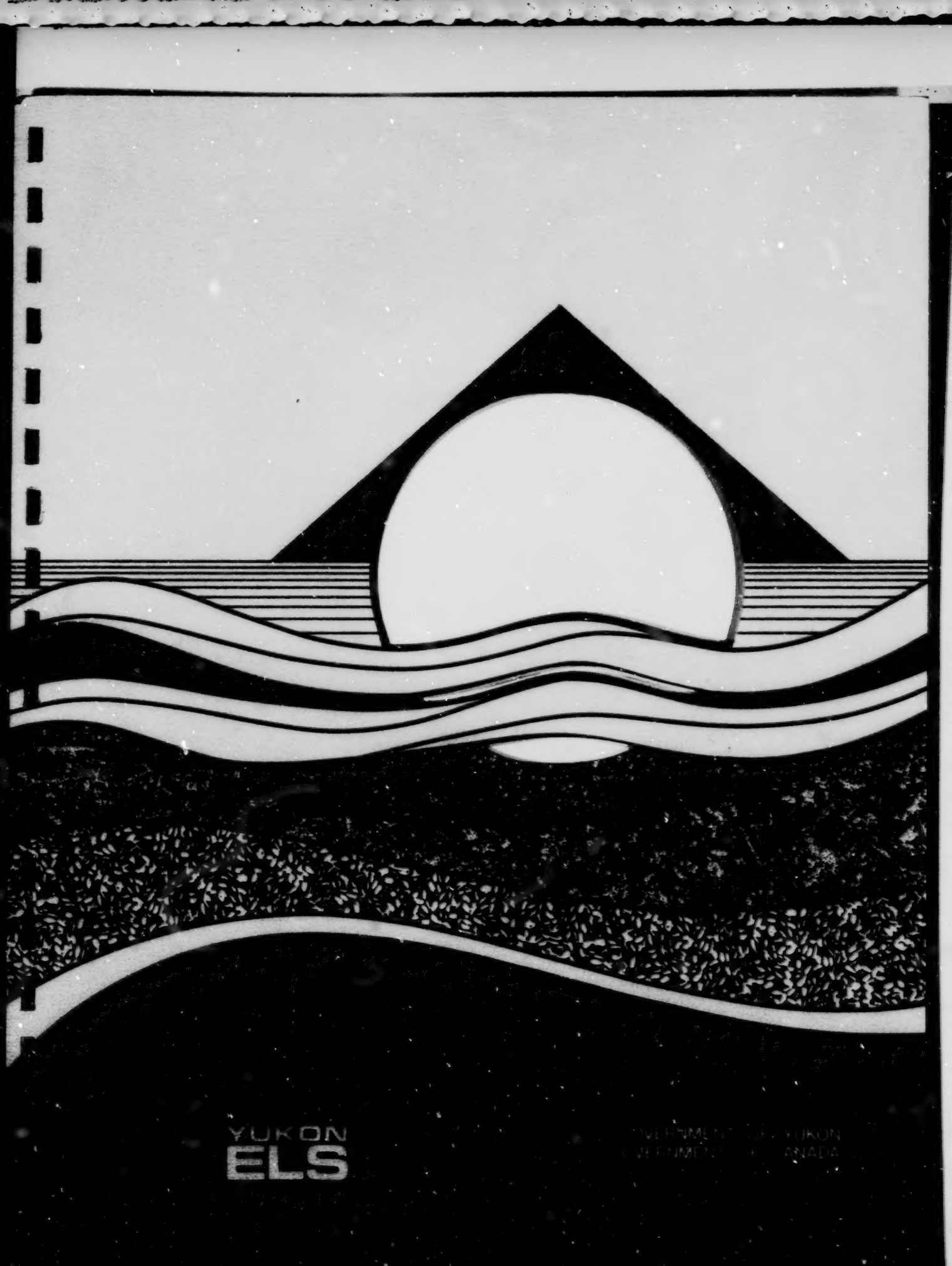
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RESOURCE INVENTORY - SOUTHERN LAKES

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July, 1983

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3. INTRODUCTION

A General Development Agreement (G.D.A.) between the Yukon Territorial Government and the Government of Canada was signed in August 1977. Under the G.D.A., the Territorial Government was able to enter into a wide range of subsidiary agreements intended to promote development in specific sectors of the Yukon economy.

The first subsidiary agreement entitled "Canada-Yukon Territorial Subsidiary Agreement on Renewable Resource Development" was signed on April 4, 1979. This agreement provided for the establishment of a Management Committee with equal representation from the federal Department of Indian Affairs and Northern Development (D.I.A.N.D.), Department of Regional Economic Expansion (D.R.E.E.) and the Government of Yukon.

The subsidiary agreement enabled D.I.A.N.D., D.R.E.E. and the Government of Yukon to jointly finance and initiate programs that would expand the resource information base to aid planning of social and economic development and the management of the territory's natural resources. It was agreed that implementation of projects was to be the responsibility of the Yukon Government.

The Subsidiary Agreement encompassed four interrelated programs:

Program I	Renewable Resource Information and Analysis
Program II	Tourism and Recreation Facilities
Program III	Resource Development Corps
Program IV	Monitoring and Evaluation

The Management Committee established four sub-committees made up of representatives from D.I.A.N.D. and Yukon Government to coordinate these with other existing programs within the respective governments. Project proposals were developed and submitted to the Management Committee for approval.

The objective of Program I as stated in the first subsidiary agreement was:

> "To provide information pertaining to renewable resources located in high priority areas of the Territory."

Regions requiring comprehensive resource inventory were identified by the Program I sub-committee. The Southern Lakes was chosen as the first study area. The study area includes Whitehorse, Yukon's capital and major population centre; other communities include Teslin and Carcross. The Alaska and Klondike highways, the major tourist routes, traverse the area. Whitehorse is the terminus of the White Pass Railway, used by mining companies, tourists and local residents. Pressure exists for agriculture, recreation, tourism and mining development in this area.

During the initial stages of the inventory program considerable time was spent in discussion with potential users of resource information. It was determined that the inventory was to provide standardized resource baseline

maps at a scale of 1:100,000 which could be utilized in preparation of regional plans. A resource inventory with surficial geology, soils, vegetation, aquatics, and archaeology components was carried out in 1980-1983.

Project coordinator was Al Hodgson. Individual disciplines were co-ordinated by C. Boyd (vegetation), D. Davies (aquatics), C. Kennedy (vegetation), J. Kuhn (vegetation), K. McKenna (soils/surficial geology) and S. Morison (soils/surficial geology). Assistance in the office and in the field was contributed by S. Davies, S. Ellenton, P. Lortie, P. Miller, G. Nassiopoulos, C. Osborne, C. Paish and P. Walden.

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The primary product of the inventory is a series of individual discipline maps; aquatics, vegetation, soil/surficial geology. A report outlining methodology, map preparation, inventory results and terrain interrelationships accompanies the map folio. A secondary product will be a selection of interpretive maps prepared through C.G.I.S. and a report describing their preparation. The interpretive maps will include a folio of various suitability and hazard maps as well as separate ecosection and ecodistrict maps.

The 1980 Southern Lakes archaeological survey, co-sponsored by the Archaeological Survey of Canada (National Museums of Canada) and the Department of Renewable Resources (Yukon Government), was undertaken in collaboration with the Ecological Land Survey program reported in this volume. A detailed report on archaeological site inventory (Greer, 1981) was submitted by the Archaeological Survey of Canada, National Museums of Canada, to augment the data base with information on the area's prehistory.

The Southern Lakes baseline maps were prepared and submitted to the Canada Geographical Information System (C.G.I.S.), Lands Directorate, in Ottawa, for entry to an interactive graphics computer system. This system allows planners and resource managers to request specific map products, to be produced on the C.G.I.S. system, utilizing the Southern Lakes data base.

This report summarizes results from the surficial geology/soils, the vegetation and the aquatic components of the inventory. Biophysical relationships have been described within the sections allocated for each discipline.

4. STUDY AREA DESCRIPTION

4.1 LOCATION

The study area encompasses what is commonly referred to as the "Southern Lakes Region", situated in the southwest corner of the Yukon, adjoining the British Columbia border (Figure 1).

In general, the study area extends from 136° (just east of Kusawa Lake) to 132°W longitude (east of Nisutlin Bay) and from 61° (southern tip of Lake Laberge) to 60°N latitude (Yukon-B.C. border). Some portions of this area to the north and east were excluded.

On the NTS grid, inventory mapping was completed for:

105D•NW	(Whitehorse)
105D•SW	(Primrose)
105D•NE, southern half	(Marsh Lake)
105D•SE	(Spirit Lake)
105C•NW, southern half	(Squanga)
105C•SW	(Teslin)
105C•SE	(Nisutlin)

The total area comprises approximately 17,987 square kilometres or 6,935 square miles.

4.2 PHYSIOGRAPHY AND BEDROCK GEOLOGY

The physiography of the Southern Lakes study area is diverse, ranging from rugged mountains in the southwest to broad valleys, large lakes and rounded hills in the north, central and eastern portions of the area (Figure 2, Bostock, 1946). The region is underlain by sedimentary, igneous and metamorphic rocks.

The Coast Mountains in the southwest (Ecoregion 6 of Oswald and Senyk, 1977) (Figure 3) are composed mainly of Cretaceous acid intrusives. They are rugged and steep, reaching elevations in the south of greater than 2300 m (7000') a.s.l. At higher elevations many small cirque glaciers are active.

The more subdued Teslin, Nisutlin and Lewes plateaus in the southeast, central and northern portions of the study area (part of Ecoregion 5 - Lake Laberge, Oswald and Senyk, 1977) are characterized by major northwest-southwest trending valleys occupied by large lakes and rivers. Older, Paleozoic limestone forms most of the bedrock surface in the southern parts of the area. The north and central areas are characterized by early Mesozoic volcanics and clastic sediments and their metamorphosed counterparts. Local Cretaceous granitic intrusions are common.

To the east, similarly trending northwest-southeast is the Big Salmon Range of the Pelly Mountains (adapted Ecoregion 4 of Oswald and Senyk, 1977) which rises 1000 m (3330') above the surrounding valleys at 750 m (2500') a.s.l. These mountains are composed mainly of older Paleozoic metamorphosed volcanics and more recent Mesozoic clastic sedimentary rocks intruded by extensive Cretaceous

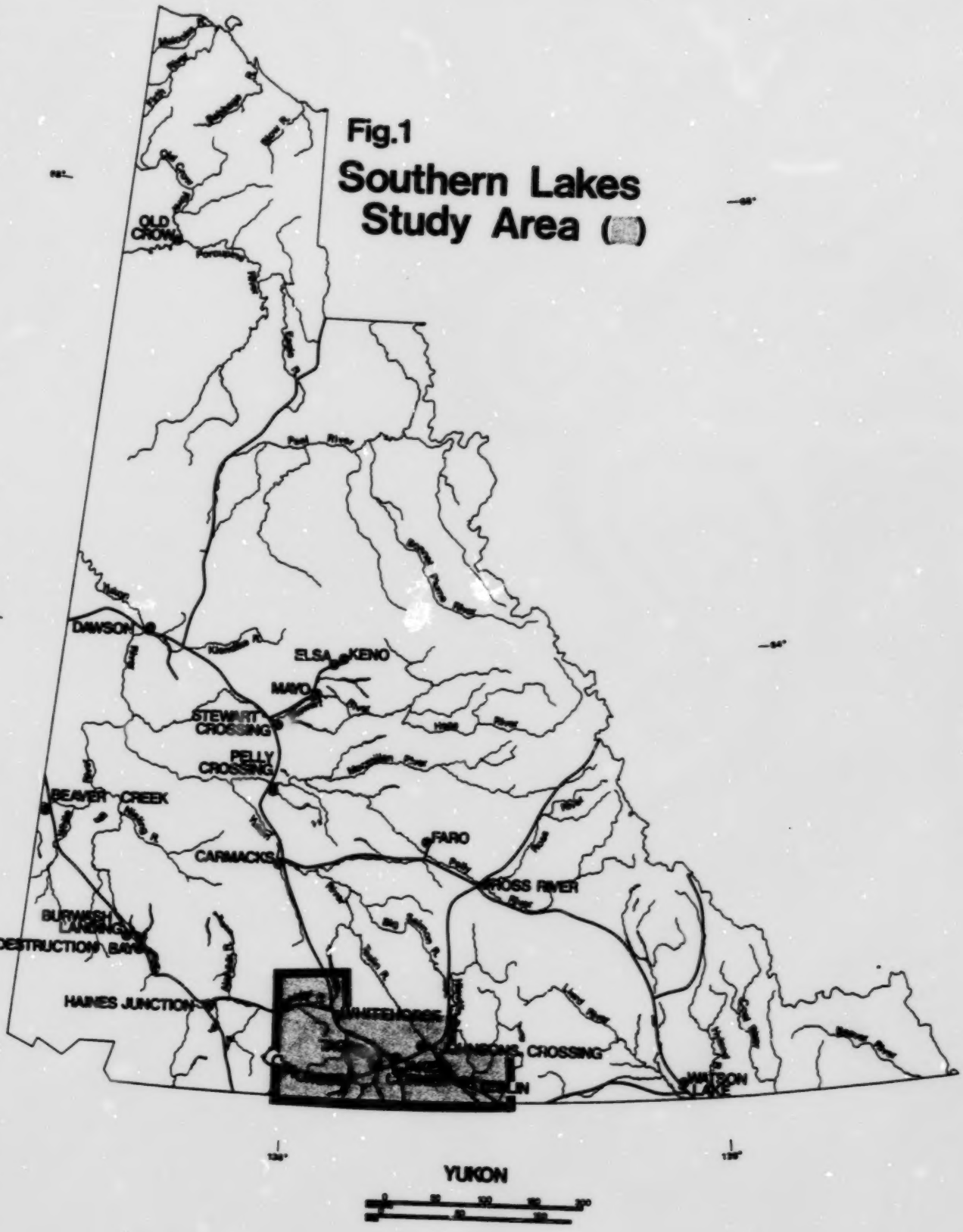


Fig.1

Southern Lakes Study Area

Fig.2

Physiographic Regions of Southern Lakes Study Area from Bostock (1946)

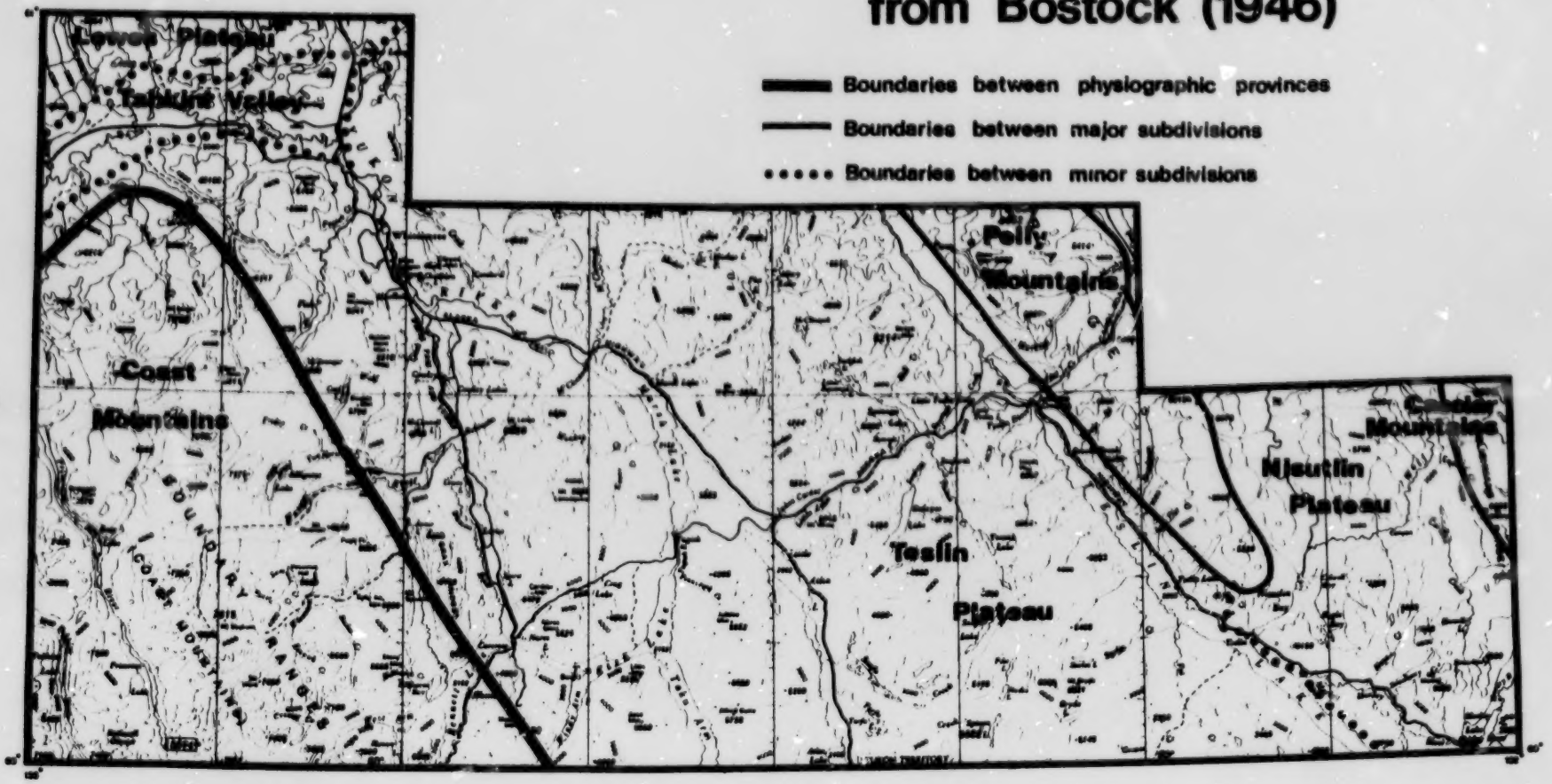
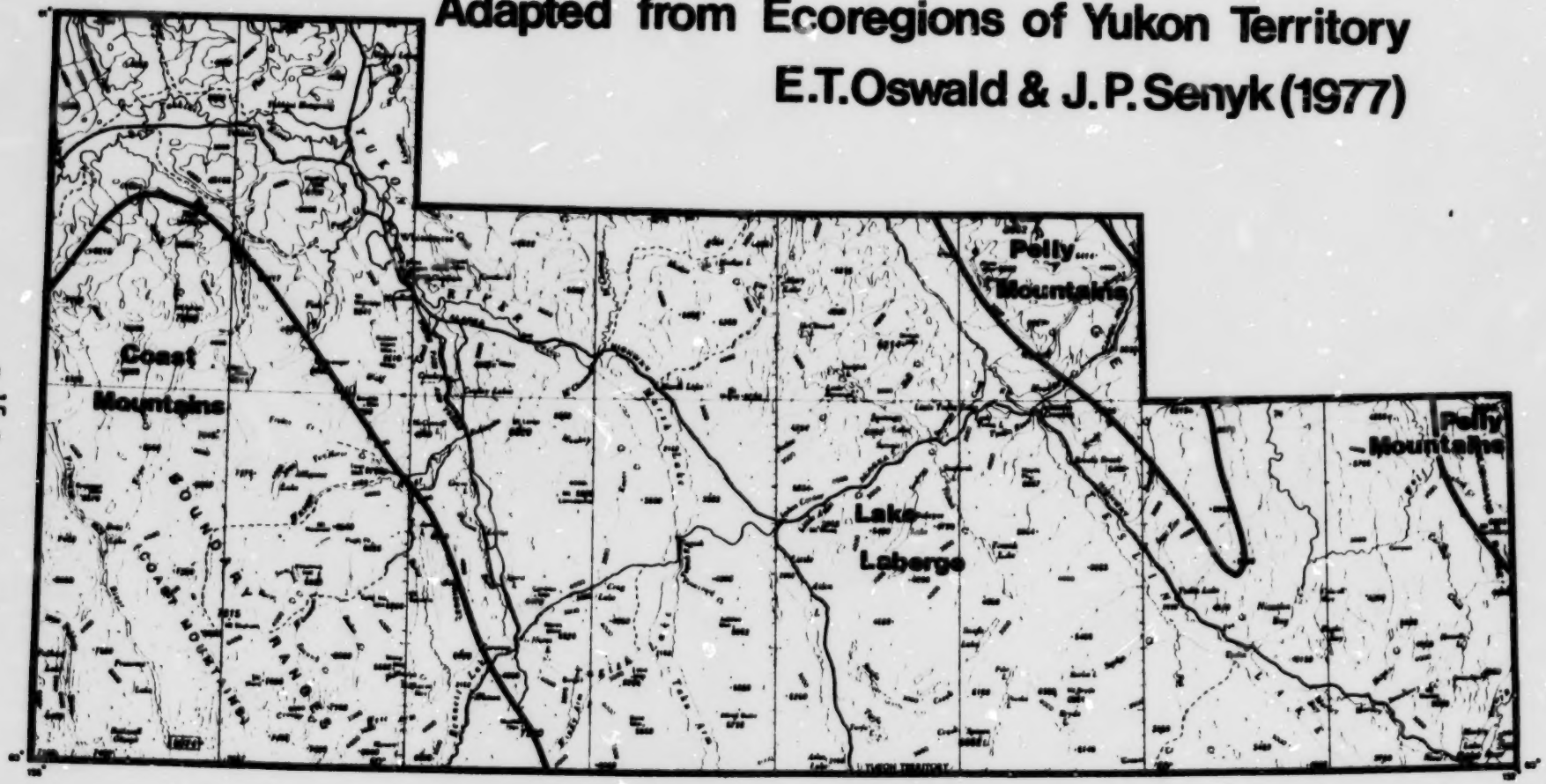


Fig.3

Ecoregions in Southern Lakes Study Area.

Adapted from Ecoregions of Yukon Territory

E.T.Oswald & J.P.Senyk (1977)



granitic rocks. The 1800 m (6000') a.s.l. Englishman Range of the Cassiar Mountains in the southeast corner, can also be considered part of Ecoregion 4 (Oswald and Senyk, 1977). Acid intrusive rocks are the main component of the bedrock. Both these ranges are characterized by numerous old cirque basins.

4.3 DRAINAGE

There is an abundance of large rivers, streams and lakes throughout the map area.

All of the drainage systems found in the study area are part of the Yukon River watershed. In addition to the mainstem Yukon River, its major tributaries include Teslin River, Takhini River and the Tagish river systems. Generally the drainage systems flow in a northerly direction. The major exception to this is the Little Atlin Lake-Lubbock River watershed. This system first flows south into Atlin Lake in British Columbia before turning north into Taku Arm.

The larger lakes found in the study area include Lake Laberge, Marsh, Tagish, Bennett, Atlin and Teslin Lakes. The southern lakes, Tagish, Bennett, Atlin and Teslin are divided by the Yukon-British Columbia border; only the lower portion of Lake Laberge extends into the northern portion of the study area boundary.

As described in Section 2.2 there are three main physiographic regions found in the study area. To the southwest there is the Coast Mountain region. This region is characterized by high gradient streams of generally low productivity. The Wheaton and Watson Rivers are the largest and most productive rivers found in this region. Deep oligotrophic lakes i.e. Tagish and Bennett, are also characteristic of the region.

The remaining areas of the study area; the Teslin, Nisutlin and Lewes plateaus and the Big Salmon Range; exhibit generally wider valleys, lower gradient meandering rivers, shallower lakes and generally higher productivity. The northwest portion of the study area is drained by the Takhini River and tributaries. The central region is drained by the Yukon River and the southeast by the Teslin River.

4.4 GLACIAL HISTORY AND SURFICIAL DEPOSITS

Though evidence for more than one major glacial advance exists for parts of the Yukon and Alaska (Wheeler, 1961), evidence for the earlier advances appears to have been obliterated in the Southern Lakes area. Most of the surficial deposits are a result of the late Pleistocene glacial events.

A late Wisconsin, McConnell advance of the Cordilleran ice sheet advancing from the Cassiar Mountains in the southeast, covered most of the region. The Coast Mountains were probably dominated by ice originating in the mountains to the south which moved northward coming into contact with the northwestward advancing Cassiar lobe.

Drumlin fields and fluting of the bedrock surface displayed in the central and eastern areas show northwestward glacier movement. Striae and the distribution of erratics indicate the northward advance in the Coast Mountains (Wheeler, 1961). Morainal deposits, deposited by the glaciers are very extensive throughout most of the valleys to elevations around 1650 m (5500') a.s.l. Erratics, rounding and scouring of the bedrock surface and abundant ice marginal meltwater streams indicate the presence of ice at elevations greater than 1800 m (6000') a.s.l. in some locations. Retreat of the ice probably ended before 12,500 years B.P.

During deglaciation, glacial lakes, dammed between retreating ice margins, stagnant ice and valley walls, occupied most of the major valleys. Glacial Lakes Champagne and Carcross, with former lake levels around 750 m (2500') a.s.l. dominated the northwest and southcentral parts of the area respectively. Many smaller valleys were also dammed. Strand lines, high level terraces and lacustrine plains mark the former extent of these lakes.

Deposited within bodies of stagnant ice disassociated from the main retreating ice mass, esker and kame complexes occur in several valleys. Glaciofluvial outwash plains, terraces and deltas are also common valley features. The general drainage trend at this time was probably toward the west and northwest (Hughes et al., 1968).

Following glaciation, when the vegetation cover was limited, extensive wind erosion and deposition occurred. Thick sand eolian blankets with parabolic dune development are found in several localities. More commonly, a thin discontinuous loess layer is found overlying many lacustrine, morainal and glaciofluvial deposits.

Further modifications to the immediate post-Wisconsin glacial topography are numerous. Sharply etched cirque valleys on north and east facing slopes are evidence of neoglacial cirque glacier activity in the Coast Mountains, Big Salmon and Englishman Ranges. Active cirque glaciers, however, are found only in the Coast Mountains. Hummocky and ridged neoglacial morainal material and small tarns occupy old, level cirque floors. Much colluviation has occurred in steep terrain resulting in fans and aprons at the base of steep rock slopes and morainal/colluvial complexes where solifluction and slumping have occurred.

Fluvial activity has also altered the topography. Alluvial fans and blankets are found at the base of slopes. Most older alluvial, glaciofluvial, morainal and lacustrine deposits have been dissected and gullied by more recent streams with active floodplains. Some peat development has occurred in alpine valleys above 1050 m (3500') a.s.l. On poorly drained lower slopes and valleys, organic veneers may overlie permanently frozen ground.

A discontinous white volcanic ash layer up to several centimetres thick is found throughout lower elevations of the study area. Known as the White River ash dated around 1250 years B.P., it is believed to originate from a vent on the northeastern flank of Mt. Bona in the St. Elias Mountains in Alaska near the Canadian border (Lerbekmo et al., 1975).

4.5 CLIMATE[1]

The climate of the Southern Lakes Study Area is cool and generally subhumid. Mean annual temperatures on major valley floors are near -1°C ranging from mean January temperatures -21°C to July mean temperatures of 13°C. Extreme temperatures have ranged from -55°C to +35°C. At higher elevations, summers are generally cooler and winters warmer.

Total annual precipitation is only 250 to 350 mm, although larger amounts do occur at higher elevations on the southern and eastern boundaries of the area. Moisture deficits of 6.4-12.7 cm occur during the growing season.

Winds are some of the highest in Yukon, particularly in south to north valleys. Appendix A contains a list of weather stations in the study area. Wind data for Teslin and Whitehorse sites are shown in Appendix B. Maps of mean annual, January and July temperatures and mean annual precipitation are in Appendix C; graphs and tables of precipitation and temperatures for six stations are in Appendix D.

4.5.1 Site Factors

Factors affecting the microclimate of a specific site are topography, elevation, latitude and proximity to large water bodies.

Topography

The Southern Lakes Study Area is a rough plateau with relief of greater than 1000 m in the more mountainous areas lying between the massive Coast Mountains and the Pelly-Cassiar Mountains. The area itself consists of deep narrow valleys in a general southeast-northwest orientation, many of which contain long, deep narrow lakes. This varied topography results in a complex climatological pattern.

In general, temperature differences are greater in the vertical than in the horizontal. Precipitation varies with elevation and location of mountain barriers. Wind fields are distorted by topography and supergradient winds can develop in valleys that lie parallel to the wind direction.

Elevation

Precipitation increases with elevation at a rate approximately 8 percent for every 100 metre elevation.

Temperatures from April through October generally decrease 6°C to 7°C per 1000 m increase in elevation, temperatures from December through mid February decrease. Temperatures are coldest on the valley floors, increase at a rate

[1]This section was adapted from Climate of the Yukon by H. Wahl (n.d.), Atmospheric Environment Services, Canada Dept. of the Environment.

of 3°C to 5°C per 1000 m up to the 1500 m level, remain almost isothermal from 1500 m to 2500 m, and then decrease again above 2500 m at a rate of 5°C per 1000 m.

Latitude

At 60°N there is a marked seasonal difference in the amount of available solar energy. On December 21 the possible hours of sunlight are only 6 hours per day as compared to 19 hours on June 21. The solar radiation is limited from early November to mid February due to the low sun angle. On an annual basis the net radiation in kilolanglies/year in the southern Yukon is 25 compared to 40 over southern Canada.

Water Bodies

Bodies of water influence the climate of an area as a source of moisture and as a source of relatively constant temperature.

Large water bodies significantly affecting the climate of the Southern Lakes Area are the Pacific Ocean and Laberge, Tagish, Marsh, Bennett, and Teslin lakes. Though also proximal to the survey area, the Arctic Ocean has a lesser effect as it is ice covered much of the year.

At its closest point the study area is within 160 km of the Pacific Ocean (Gulf of Alaska). Winds and clouds originating over the Gulf moderate both winter and summer temperatures. In winter, Gulf air is relatively warm and associated cloud reduces radiational cooling; conversely, in summer, Gulf air is relatively cool and associated cloud reduces the amount of solar heating.

Cloud and fog produced over the large lakes similarly moderate early winter temperatures but on a more local scale. These lake valleys may contain fog and cloud for prolonged periods in November and occasionally into December and January until the lakes freeze over.

In spring and early summer the lakes are generally cooler than the surrounding land and may significantly reduce surrounding air temperatures up to 4 km in distance.

4.5.2 Temperatures

Temperatures in the Southern Lakes Area are less extreme than those in other parts of Yukon. As discussed, the Pacific Ocean and large lakes moderate temperatures. In addition the relatively higher elevations of the area, result in less extreme maximum and minimum temperatures. From April through October temperatures decrease 6°C to 7°C per 1000 m increase in elevation. Strong radiational cooling from November through February reverses this temperature trend at lower elevations; temperatures increase with elevation at an average of 5°C per 1000 m up to elevations of 1500 to 2500 m. Above these elevations, temperatures again generally decrease at 5°C per 1000 m. Under extreme winter

conditions there have been increases of 20°C to 30°C in temperature in the 500 m above the valley floor.

Mean January temperatures are near -20°C at the 700 m level of the major valley floors and rise to near -15°C at the 1500 m level. Extreme temperatures in January have ranged from -52.8°C at Teslin to +9.0°C at Whitehorse. By mid February, some solar day heating begins to occur. By mid April mean daily temperatures are near zero with mean minimums near -6°C and maximum near +5°C.

July is the warmest month with mean minimums near 6°C and mean maximums near 20°C. Midsummer frosts have occurred at all sites even in July. Sheltered east-west valleys are the most susceptible.

Although cooling is evident by August, major cold spells are uncommon until mid to late October. Extreme cold weather is generally delayed until December by the moderating effects of the Pacific and the large lakes in the area.

4.5.3 Precipitation

The main source of moisture bearing winds in Southern Yukon is the Pacific Ocean. The Coast and St. Elias Mountains are however an effective barrier. Extensive cloud may reach the study area from Pacific storms, but generally only light precipitation will occur. The mean annual precipitation map (Appendix C) depicts this precipitation field.

The Southern Lake Area lies in the rain shadow to the lee of the St. Elias and Coast Mountains and is part of the most arid area of Yukon. Mean annual total precipitation amounts are generally only 250 to 350 mm, on the valley floors. There is a general increase in precipitation with increased elevation, some 8 per cent increase per 100 metre increase in elevation. Considerably heavier precipitation occurs on the southward extension of the Big Salmon Range immediately northeast of Johnson's Crossing and again on the western slopes of the Cassiar Mountains to the east of Teslin.

The least precipitation occurs in late winter, early spring and the greatest in July and August. Relatively heavy precipitation however, continues to occur in the Southern Lakes area through November, due to active Pacific storms which are prevalent in the Gulf of Alaska at that time of year.

In the major valley floors the total annual precipitation consists of slightly more rain than snow. The proportion due to snow increases with increase in elevation. The maximum depth of snow on the valley floors generally occurs in early March with amounts of 30 to 60 cm with the deepest amounts in the eastern valleys. Snow depths increase with elevation but no evaluation can be made due to limited data.

4.5.4 Wind

The Southern Lakes Study Area is subject to considerable wind due to its proximity to the Gulf of Alaska and its active storm centres. The prevailing

winds are southerly but the strongest winds are generally from the southwest.

Wind data are available from airports at Whitehorse and Teslin. It is recommended that for planning purposes, the Whitehorse data be used particularly for north-south valleys. The average annual wind speed at Whitehorse is 14 km/hr. with the probable extreme gust of 102 km/hr. Although no data is available from Windy Arm and Bennet Lake, it is believed that the probable extreme gust speed exceeds that even of Burwash, which is 172 km/hr.

4.6 Soils

Soils form through the interaction of geologic parent materials, climate topography and biological organisms over time. Soil development refers to the weathering of surficial deposits, the lateration of the minerals therein, and the accumulation and incorporation of organic matter within the surface mantle. Variation in any of these soil forming factors results in differing soil development.

The Southern Lakes study area coincides with the very cold subarctic and cold cryo-boreal soil climate zones of Canada (Clayton et al. 1977). Major topographic barriers influence the soil moisture regime and subclasses which range from sub-humid to humid. Due to the cold, relatively dry environment, rates of biological activity and mineral weathering are slow, leading to weakly developed soils.

Permafrost in the study area is discontinuous (Brown 1967). More recent studies have indicated that permafrost may be more widespread than previously thought based on climate, drilling and ground temperature measurements along proposed pipeline routes (Harris 1983). According to Harris continuous permafrost underlies most of the study area except along larger valleys. Abundant ground ice is however usually restricted to areas of fine-grained deposits adjacent to surface water, ground-water discharge or bedrock valley walls, where sufficient groundwater is available for growth of ground ice (Rampton et al. 1983). Extensive ground ice is found therefore in some valley floor organic and alluvial deposits, on some lower seepage sites in some alpine areas, and associated with thermokarst topography in some glaciolacustrine sediments.

The topography is varied in the Southern Lakes Study Area, ranging from rugged mountains to gently undulating plains. A variety of soil types is therefore encountered due to the range in surface morphology, slope and elevation.

Vegetation type and rate of growth also affect the soil. Predominance of coniferous trees probably increases the acidity of the soil. Slow growth of vegetation leads to slow production of organic matter.

Soil parent materials are derived from a variety of bedrock sources and range from strongly acid reactions on some morainal deposits, to mildly alkaline on calcareous lacustrine and morainal. Saline parent materials occur less frequently.

Brunisolic soils, widely distributed throughout the study area, usually develop on rapidly to moderately well drained medium (loamy) and coarse (sandy, gravelly) textured parent materials. These weakly developed soils are characterized by their brown to reddish colours and low organic matter content. Brunisolic soils are found primarily under coniferous and mixed forest cover and occasionally under park-land, shrub or grassland areas.

On finer (clay and silt) textured parent materials, Luvisolic soils, and also associated with spruce or mixed forest cover may be encountered. They are characterized by brownish colours and a subsurface accumulation of clay. This accumulation may restrict root growth and permeability. These soils have limited distribution in the study area.

Where materials are rejuvenated through frequent deposition or disturbance, as on alluvial floodplains and steep colluvial slopes, evidence of significant weathering does not exist. These are classified as being Regosolic (unweathered) soils. Surface vegetation may be in early successional stages or lacking entirely.

High water tables, ground water discharge (seepage), and slow permeability lead to poorly drained conditions which alter soil morphology. The saturation of materials for continued periods of time result in strong chemical reduction of the soil environment producing Gleysolic soils. These are characterized by dull blue and grayish colours and often peaty surface layers. Willows, wetland mosses and spruce are usually associated with Gleysols.

Organic soils develop through the accumulation over long periods of time of plant debris in shallow water bodies and poorly drained sites. The resultant peaty soils, typically moderately decomposed, are poor to very poorly drained and support sedge, willow or sphagnum moss growth.

Cryosolic soils are those with permafrost present within one to two meters of the ground surface. As ground ice may be found in many materials, these soils have a variety of appearance. Cryosols are often associated with willow, black spruce or alpine tundra vegetation.

4.7 Vegetation

The vegetation of the Southern Lakes reflects the region's strongly divergent physiography.

The coastal mountains of the southwest (Ecoregion 6, as defined by Oswald and Senyk, 1977) host a largely tundra environment, in contrast to the boreal communities that prevail across the lower elevation plateaus and hills to the north and east (Ecoregion 5, Figure 3).

In the southwest the terrain is rugged and falls under a harsh climatic regime. A significant portion of land is covered by icefields, cirque basins and talus and remains non-vegetated. Expansive, high elevation slopes are dissected by narrow forested valleys. Lichen, *Dryas*, graminoids, prostrate willows and ericaceous shrubs blanket exposed alpine slopes while shrub birch and willows colonize draws and high subalpine valleys. Scattered white spruce dominate lower subalpine elevations, with only rare occurrences of alpine fir. Although valley bottoms are typically forested in white spruce, pine is often found on south-facing terraces and at river confluences. Aspen occurs occasionally on sunny slopes at low and mid elevations. Ericaceous shrubs, willows, sedge and sphagnum establish in depressional sites, although black spruce is all but absent throughout the southwest.

By contrast, the northern, central and eastern portions of the study area are characterized by rolling hills interspersed with low lying drainages. Pure stands of lodgepole pine in varying seral stages predominate lower elevations, a reflection of the frequent fires which characterize the region. The more recently burned areas to the northwest (Takhini burn) and southeast (Teslin burn) are colonized by aspen, willows and/or young pines. White spruce usually forms the primary regen and is the climax species. Black spruce is common on more poorly drained sites, particularly in the eastern portion of the study area. Eskers and terraces throughout the area maintain communities of aspen, sage and grass on their south facing aspects. Occurrences of balsam poplar exist along the shores of the larger meandering rivers. Toward the east, alpine fir often replaces, or occurs in conjunction with white spruce at subalpine elevations. Higher slopes are dominated by shrubs, lichens and forbs.

4.8 Fisheries

In the Southern Lakes Study Area sixteen fish species have been recorded. They are chinook salmon, coho salmon, rainbow trout, cutthroat trout, arctic grayling, lake trout, lake whitefish, broad whitefish, round whitefish, inconnu, northern pike, burbot, longnose sucker, least cisco, slimy sculpin and lake chub.

Over half of the population of the Yukon lives in or in close proximity to Whitehorse. Coupled with the aquatic resources available sport fishing is very popular and angling effort is intense in this area. The most popular sport species are lake trout and arctic grayling. In addition to sports fishing, a commercial and domestic or subsistence fishery exists.

The productivity of Yukon waters is considerably lower than southern provinces. A comparison made with lakes in south-central British Columbia showed productivity to be six to ten times that of Yukon lakes (Paish, 1981).

4.9 WILDLIFE

4.9.1 Mammals[2]

Glacial history largely determined the species composition of mammalian wildlife in the Southern Lakes area of the Yukon. This region is a sort of meeting ground between species that migrated south from ice-free Beringia, Alaska and those that migrated north from unglaciated regions of southern North America. Of the 47 terrestrial mammals found in this region, 35 (75%) are southern immigrants, 10 (21%) are from the Beringian refugium while the remaining 2 (4%) arrived from the Rocky Mountain refugium. All but 11 Yukon mammal species are found in the Southern Lakes region.

If glacial history determined the distribution of wildlife, then the relatively severe climate determines their abundance. Of the 37 southern immigrants, 21 (57%) reach the northern limit of their North American distribution in the

[2]This section was written by Don Russell, BSc, MSc.

southern Yukon. Some notable species such as mule deer, mountain goat, stone sheep, cougar and fisher are included in this group. Other southern migrants such as porcupine, muskrat, red fox, coyote, black bear, marten, otter and lynx are ubiquitous throughout the Yukon but, availability of habitat being equal, reach their highest densities within the Territory in the Southern Lakes region.

4.9.2 Birds[3]

In the Southern Lakes Area, avian species diversity is relatively large (over 200 species) for a northern region, reflecting the complex array of habitat types found there. Extensive alpine areas are common in the region, providing nesting habitat for three species of ptarmigan and their avian predators including the gyrfalcon and golden eagle.

Subalpine areas support blue grouse habitat at the northern limit of its range. Also using the subalpine are a healthy community of golden-crowned sparrows and typically tundra-nesting passerines such as tree sparrows and red polls. Forested habitats support boreal forest bird communities including dark-eyed juncos and yellow-rumped warblers. Small alpine lakes are also common and have recently been identified as nesting habitat for trumpeter swans.

The location of the region on the interior slopes of the coastal ranges (which apparently channel overland bird migration to and from the large land mass of Alaska), greatly affects the seasonal abundance of birds. Of special focus in this regard are some notable spring staging areas at the outlets of the larger lakes considered critical to many pre-nesting waterfowl. Swans, geese and diving and dabbling ducks all use these areas in large numbers during northward migration.

4.10 ARCHAEOLOGY[4]

Simply stated, archaeology is concerned with the human history and past use of a geographic area. In the Southern Lakes district, the techniques of archaeology can reveal much about the human past through investigation of sites dating to the prehistoric and historic periods.

Except for one recently initiated study (Greer n.d.), systematic research on sites of any particular age or type has never been completed in this area. Nonetheless, recent field inventory work here has documented the presence of numerous archaeological sites. Two projects in particular have recorded most of the known sites: the Alaska Highway Natural Gas Pipeline Project (Van Dyke and Reeves 1978, Van Dyke 1979, 1980), and the 1980 Southern Lakes Archaeological Survey (Greer, 1981). A few sites had been recorded by earlier researchers but none were ever investigated in any detail.

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[3]This section was written by Dave Mossop, B.Sc., M.Sc.

[4]This section was written by S. Greer, M.A.

During the 1980 Southern Lakes field season over 250 new archaeological sites were recorded. This number was increased with further survey work during the 1982 season (Greer, n.d.). The result is an extensive, though not exhaustive, regional inventory of archaeological sites, surpassing in quanitity that known for any other part of the Canadian subarctic north of 60°.

Of the known sites in the Southern Lakes district, a number have already been entirely collected or destroyed, and thus are of no further concern. However, it is noteworthy that many sites were found in a good state of preservation and with some form of natural stratigraphy, a situation which allows separation of the various cultural components found therein.

The majority of archaeological sites recorded in the Southern Lakes study area date to prehistoric times, when stone and bone tools were used. They are located in a wide range of topographic settings but are frequently situated beside lakes and rivers or in locales that are important for fish and game. These sites provide us with the means for investigating a range of problems concerning the prehistoric past. For example, what have been the subsistence and settlement (or more simply, economic) patterns of the groups once resident here? This information can be reconstructed through the analysis of site locations, game hunting and fishing structures, e.g. corrals, weirs, etc., and the animal bones preserved at sites.

The Southern Lakes district also appears to have great potential for the study of prehistoric trade. A number of exotic raw materials such as obsidian, native copper and dentalium shell have been found in sites. Analysis of these materials can provide information on the nature of contacts between people of this area and regions such as the Northwest Coast, central and northern interior British Columbia, central Yukon, the Mackenzie basin, etc.

Establishing the chronological sequence of prehistoric cultural events for the area is a top priority for future research. From the artifacts collected to date it is apparent that several different prehistoric cultures have occupied this area. Stone tools assignable to the Little Arm, Taye Lake, and Aishihik prehistoric cultures (Workman, 1978) have been found, which suggests that several thousand years of prehistory are represented in the archaeological sites of this district. The age of the earliest human occupation is not yet known however. Based on geomorphological data from the study area and archaeological evidence from the nearby Aishihik-Kluane region (Workman, 1974), a date of ca. 7000 years ago would not be unexpected.

A few sites have been recorded with components dating to the protohistoric period, that interval during the nineteenth and perhaps the late eighteenth century, when European-derived goods were being traded into the study area, but before any outsiders had yet arrived. From the ethnographic record (McClellan, 1975), it appears that this was a dynamic period of native history, and therefore one of considerable research interest. During this period the Coast Tlingit Indians were trading extensively with and marrying the interior peoples of the Southern Lakes area, the ancestors of the Tagish, Inland Tlingit, and Tutchone peoples.

The historic period sites data from the late nineteenth to the early twentieth century; they represent the results of hunting, fishing, trapping, trading, and mining activities by native and non-native persons. Included in the list of historic sites are the Tagish Northwest Mounted Police Post and various native traditional hunting and/or fishing camps. The inventory of historic sites is not complete however, and considerably more archival and field research is needed to assess their extent and importance.

In summary, the study area features important archaeological sites, about which we know very little at present, but which appear to have significant value for research, educational and interpretive purposes.

5. SOILS AND SURFICIAL GEOLOGY

5.1 Methodology - Sampling and Mapping

Field work, June through September 1980, was based from Spirit Lake, 10 km north of Carcross and Teslin Lake, 30 km north of Teslin, as well as from Whitehorse. Data compilation and map preparation followed from 1980 through 1983.

5.1.1 Field Sampling

The field component of the geology and soils section of the inventory was preceded by compilation of available regional geology and soils information. Preliminary air photo interpretation of landforms and the corresponding genesis of surficial sediments was completed. This pretyping, based on the interpretation done by Klassen (1979), was done on 1979 1:50,000 and 1971 1:70,000 air photos and transferred to 1:100,000 base maps (Appendix G for list of air photos used). The preliminary terrain maps formed the basis for detailed planning of the aerial traverses and representative site selection.

During 1980, the preliminary interpretation was checked and refined by helicopter, road and foot traverses. During helicopter traverses, terrain features were described onto a tape recorder while aerial locators were marked on air photos. All major and many minor roads were traversed; parent materials of all exposures were noted. Foot traverses were undertaken in areas of special interest.

Two hundred and forty-nine detailed ground sites along the traverses were visited to verify preliminary map unit designations and to characterize those map units with respect to site conditions, soil development and parent materials. At each site, site conditions and the genesis and characteristics of parent materials were recorded using site, surficial geology/soils and stratigraphy and photography field cards (Figures 4-6). The cards were based mainly on those developed by Resource Analyst Branch (RAB)(Walmsley et al., ed. 1980) and The Canada Soil Information System (CanSIS)(Dumanski, ed. 1978). Munsell Soil Color Charts (1975) were used to describe the color of the soil. Profiles were described and classified using the Canadian System of Soil Classification (1978).

5.1.2 Lab Analysis

Representative parent material samples were taken for lab analysis[5] to further characterize the parent materials and soil association members. Texture, pH, calcareousness, salinity and nutrient status were determined. (Examples of lab analysis are in Appendix H.) Some full soil profiles were sampled from typical sites to outline relationships between parent material, site conditions, vegetation and the degree and type of soil development. A complete record of

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[5]The contribution of Charles Tarnocai and the Land Resource Research Insitute, Agriculture Canada, Ottawa, Ontario in the analysis of all soil samples is gratefully aknowledged.

all lab data and related field information is on file with CanSIS, Land Resource Research Institute, Research Branch, Agriculture Canada, Ottawa.

5.1.3 Development of Soil Associations

Once field work was completed, a legend for soils was developed. Soil associations characterized by similar parent materials occuring under similar climatic conditions due to variation in relief and drainage were determined (according to the approach used by the Canadian Soil Survey, Agriculture Canada) from the surficial geology polygons. Where two parent materials are commonly so intermixed locally that they are impossible to separate at the mapping scale, soil association complexes have been established to describe the soils. For example, complexes of till and colluvium found on many slopes, belong to the Gray Ridge Association. Association members such as Gray Ridge 1 and Gray Ridge 2 occur on similar materials under different site conditions.

The vegetation communities (see the vegetation community descriptions found in section 6.2) most commonly associated with each soil subgroup are included in the association descriptions.[6] Communities successional to those mentioned are also common but have not always been included.

Figure 7 is a summary of the dominant and significant soil subgroups for each association member with the corresponding parent materials, drainage, topography and vegetation communities. Schematic cross-sections (see soil association descriptions 5.2.1) show the position of each soil association in the landscape.

Soil associations have been given local names. Association names for Champagne and Watson River Associations are those used by Day (1962) and Rostad et al. (1977), respectively. In cases where the parent materials mapped were not considered identical to those described by other surveyors, new soil names have been used. These names were cleared with the "names file" in the Canada Soil Information System (CanSIS).

5.1.4 Map Preparation

Using the soils legend, the preliminary surficial geology/landform air photo boundaries were refined and the polygons were subdivided according to site conditions.[7] The final boundaries were then transferred to 1:100,000 base maps. Map unit designators are a combination of those used by the Province of British Columbia (Walmsley et al., 1980) and the Geological Survey of Canada (Klassen, 1979). They describe a complex of up to three genetic

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[6]The assistance of C. Boyd in correlating vegetation communities with soil association members is acknowledged.

[7]The valuable assistance provided by S. Morison (Geology Section, DIAND; formerly of the Resources Planning & Management Branch, Dept. of Renewable Resources, YTG) in development of soil associations, in interpretation of aerial photographs, and in the coordination of the field work and logistics, is gratefully acknowledged.

YUKON ECOLOGICAL LAND SURVEY
SITE DESCRIPTION

Page_____ of_____
Site Number_____

1. Project Identification_____ 2. Date (Y/M/D)_____
3. Site Investigator(s)_____
4. Ecoregion_____ 5. Ecodistrict_____
6. Ecosection_____ 7. Traverse Number_____
8. NTS Sheet_____
9. UTM-Easting (m)_____ 10. UTM-Northing (m)_____
11. Latitude_____ ° ' " 12. Longitude_____ ° ' "
13. Photo # & Co-ord. Flightline_____ Photo #_____ X_____ Y_____
14. Location_____ 15. Representiveness Comment_____
16. Weather_____ a. Typical_____
b. Atypical_____

17.

a	Elevation	
b	Source of Elevation	
c	Aspect	
d	Slope %	
e	Nature of Slope	
f	Site Position Macro	
g	Site Position Meso	
h	Microtopography	
i	Exposure Type	
j	Soil Moisture	
k	Soil Drainage	
l	Seepage	
m	Flood Hazard	

18. Surface Material

Substrate	% Cover
Litter (<10 cm)	
Wood (>10 cm)	
Bedrock	
Inorganic (<64mm)	
Inorganic (>64mm)	
Organic	
Peat	
Water	
TOTAL	100%

19. Notes on Site Description_____

20. Site Diagram

Site Photograph

Photographs	Black & White				Color				Polaroid			
	Roll	Initials	From	To	Roll	Initials	From	To	Roll	Initials	From	To

Figure 4 Site Description Field Card

SURFICIAL GEOLOGY/TERRAIN CLASSIFICATION
SITE DESCRIPTION

Investigator(s)_____ Site Number _____ Page ___ of ___

21. Terrain Classification				22. Landforms							
Tex. Mod.	Gen. Mtl.	Surf. Exp.	Mod. Proc.	Name	Length (m)	Width (m)	Height (m)	Local Relief (m)	Age	Mod. Proc.	Age

23. Stratigraphy (see Stratigraphy card ☐)

Observation	Unit	Sample	Depth (m)	Thickness (m)	Genetic Mat.	Age	Dominant Tex.	Minor Tex.	Effervescence	Cementation	Color (dry / wet)	Structure	Lower Contact	Misc. Comp.

24. Ice - Movement Indicators	
Type	Azimuth

25. Permafrost				
Active Layer d.	Organic Horizon	% Ice Content	Ice Type	Patterned Ground

26. Bedrock Type (listed in order of dominance) _____ / _____ / _____

Comments: _____

SOIL DESCRIPTION (see editional Soil Description card)

Investigator(s)_____ Site Number _____ Page ___ of ___

27.

Horizon Desig.	Horizon Depth	Coarse Fragment Data: by Volume	Gravel	Cobbles	Stones	Soil Texture	Structure: Grade	Class	Kind	Kind MOD.	Color: Munsell	Aspect	Mottles: A.B.	S.I.	C.O.	Roots: A.B.	S.I.	O.R.	D.I.	Lab Sample No.

29. Schematic Soil Profile

10 0 25 50 75 100

28.

Horizon Desig.	pH: Reaction	Method	Effer.	Sol.	CEM.: Ag.	Deg.	Ext.	Organic Mat. Desc.: Mat. Comp.: Kind	Des.	Von Post	Ice Content H/M/L	Consistence	Horizon Notes

30. Depth to: (cm)
a) water table _____
b) frost _____

31. Soil Classification _____
General Comments _____

Figure 5 Surficial Geology/Soils Field Card

STRATIGRAPH continued

Investigator(s)_____ Site Number_____ Page___ of___

Observation	Unit	Sample	Depth (m)	Thickness (m)	Genetic Hor.	Age	Dominant Tex.	Maximum Tex.	Effer.	Cem.	Color (dry/wet)	Structure	Lower Contact	Misc. Comp.

Comments:_____

PHOTOGRAPHY

Site Number_____ Page___ of___

Notes on Photography_____

Site Photograph	Site Photograph

Photographs	Black & White				Color				Polaroid			
	Roll	Initials	From	To	Roll	Initials	From	To	Roll	Initials	From	To

Figure 6 Stratigraphy and Photography Field Card

materials, and related surface expressions, modifying processes and soil association. On site symbols show major slope failures, gullies, channels, dunes and glacial features. The map legend is in Figure 8. The result is a soil/surficial geology map based on the interaction between parent materials, landforms, climate and soil drainage.

5.1.5 Computerization of Data

The surficial geology/soils maps in conjunction with the vegetation and aquatic maps have been input to CGIS (Canada Geographical Information System), a component of CLDS (Canada Land Data System) developed by Environment Canada. The maps were scribed and polygon designators were keypunched. Elevation range, average slope class and dominant aspect accompany the designators for each soils/surficial geology polygon. A legend for the data base is in Appendix I. CGIS establishes a permanent Southern Lakes Resource data base including soils, surficial geology, vegetation and aquatic information, which can be analyzed and manipulated. The data output can be presented in tabular or in geographical format. The system's versatile capabilities make it an important tool for land use planners and managers.

5.2 Description of Soil Associations[8]

Soil Associations, consisting of soils developed on similar surficial materials, and under similar climatic conditions, are described with respect to landforms, position in the landscape, elevation, soil drainage, parent material characteristics such as texture and soil chemistry, permafrost and associated vegetation communities (Section 6.2). Figure 7 is a summary of the dominant and significant soil subgroups for each association member.

5.2.1 Champagne Association

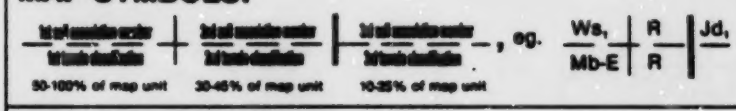
The Champagne Association consists of soils developed on lacustrine and glaciolacustrine deposits found in plains, valley floors and terraces. These deposits are found in most major valleys of the study area including the Teslin, Tagish, Takhini, Yukon, McClintock River, Atlin-Little Atlin Lake and Cowley Lake valleys (Plate 1). The topography in these areas is level to gently sloping (0-20%) with a relatively smooth surface. As a rule, lacustrine deposits do not occur above 900 m (3000') a.s.l. except in some smaller valleys such as Watson River and Alligator Lake valleys where lacustrine deposits around 1050 m (3500') a.s.l. show higher local lake levels. Thickness of the deposits is variable. Near Teslin Lake, lacustrine terraces reaching 40 metres high are found.

The parent material has a textural range from heavy clay to fine sandy loam, with loam to silt loam being the more dominant textures for lacustrine materials (Figure 16). The material is generally slightly calcareous to strongly calcareous, friable to firm, moderately to slowly pervious and usually stone free. The variability in calcareousness is probably due to the heterogeneity of the source material. In terms of geologic structure,

[8]This section was developed from a preliminary draft by S. Morison (DIAND, formerly of the Dept. of Renewable Resources, YTG) and from Y. Woo (1980).

SURFICIAL GEOLOGY AND SOILS

MAP SYMBOLS:



50-100% of map unit 30-65% of map unit 10-35% of map unit

SOIL ASSOCIATIONS

Soil Texture	Coarse Fragments	Soil Association Complex	Soil Association Subgroup	Drainage	
				Sub Groups	
SL – L	GR : CB	Champagne	Ch 1	Orthic Eutric Brunisol Orthic Gray Luvisol	W M
			Ch 2	Orthic Humic Regosol Orthic Melanic Brunisol	M I
			Ch 3	Orthic Humic Gleysol Rego Humic Gleysol	I P
			Ch 4	Orthic Eutric Gleysol	M VP
SL – SL	GR : CB	Morley Bay	Mb 1	Orthic Eutric Brunisol	W M
			Mb 2	Brunisolic Eutric Brunisol	M I
			Mb 3	Orthic Humic Gleysol Rego Humic Gleysol	I P
LS – S		Caraway	Ca 1	Orthic Regosol	VR -
			Ca 2	Orthic Dystric Brunisol Orthic Eutric Brunisol	VR R
LS – S	GR : CB	Jumbo Creek	Jd 1	Orthic Eutric Brunisol Orthic Dystric Brunisol	R W
			Jd 2	Brunisolic Eutric Brunisol	M I
L – S	GR : CB	Beatrice Basin	Bb 1	Orthic Eutric Brunisol Orthic Dystric Brunisol	R M
			Bb 2	Brunisolic Eutric Brunisol Brunisolic Dystric Brunisol	M I
			Bb 3	Orthic Gleysol Orthic Humic Gleysol	I P
SL – S	GR : CB	Starlin	St 1	Orthic Eutric Brunisol Orthic Dystric Brunisol	W M
			St 2	Brunisolic Eutric Brunisol Brunisolic Dystric Brunisol	M I
SL – SL		Wheaton River	Wt 1	Rego Gleysol	VP P
			Wt 2	Orthic Humic Gleysol Orthic Gleysol	P I
SL		Klondike	Ns 1	Rego Gleysol Gleysol Regosol	P I
			Ns 2	Terric Mesisol Terric Mesic Organic/Cryosol	VP P
L – SL	GR : CB	Watson River	Ws 1	Orthic Eutric Brunisol Orthic Dystric Brunisol	W M
			Ws 2	Brunisolic Eutric Brunisol Brunisolic Dystric Brunisol	M I
			Ws 3	Orthic Humic Gleysol	I P
			Ws 4	Orthic Turbic Cryosol	W M
L – SL	GR : CB	Grey Ridge	Gr 1	Orthic Eutric Brunisol Orthic Dystric Brunisol	W M
			Gr 2	Brunisolic Eutric Brunisol Brunisolic Dystric Brunisol	I M
			Gr 3	Orthic Humic Gleysol	I P
			Gr 4	Orthic Turbic Cryosol	W M
SL	GR, CB, ST	Dublin Mountain	Ca 1	Orthic Eutric Brunisol Orthic Dystric Brunisol	W M
			Ca 2	Brunisolic Eutric Brunisol Brunisolic Dystric Brunisol	M I
			Ca 3	Orthic Regosol	W R
		Rockland	R	Regosol	
SL – S	GR, CB, ST	Tidy Hill Mountain	Th 1	Orthic Regosol Regosolic Turbic Cryosol	M W
		Two Mile Creek	Tn 1	Terric Mesisol	P -
			Tn 2	Terric Mesic Fibrisol	P VP

SOIL TEXTURE		SOIL TEXTURE		COARSE FRAGMENTS		DRAINAGE	
HC	heavy clay	SL	silt loam	GR	gravelly	VR	very rapidly
C	clay	L	loam	CB	cobbles	R	rapidly
SC	silty clay	SL	sandy loam	ST	stones	W	well
SCL	silty clay loam	LS	loamy sand			M	moderately well
CL	clay loam	FS	fine sand			I	imperfectly
SCL	sandy clay loam	S	sand			P	poorly
Si	silt	CS	coarse sand			VP	very poorly

Surficial Geology and Soils Map Legend Cont'd.

TERRAIN CLASSIFICATION

s M b , v - E , V

- modifying process (channelled, gullied)
- surface expression (blanket, veneer)
- genetic material (morainal)
- textural modifier (sandy)

Genetic Material	Surface Expression	Modifying Process	Textural Modifier
A Alluvium	a apron	A Anastomosed	a blocky
C Colluvium	b blanket	B Bevelled	r rubbly
E Eolian deposits	d delta	C Crystallized	g gravelly
G Glaciofluvial deposits	f fan	D Deflated	f fine
L Lacustrine deposits	h hummocky	E Channelled	b bouldery
M Morainal deposits	m rolling	F Fluted	k cobbly
O Organic deposits	p plain	H Kettled	p pebbly
R Bedrock	r ridged	K Thermokarst	s sandy
I Glacial Ice	s steep	N Nivated	S silty
	t terraced	S Solifluxated	c clayey
	v veneer	V Gullied	e fibric
	x complex	W Washed	m mesic
			h humic
			w woody

AERIAL TRAVERSES AND SITE LOCATIONS

Fieldwork by: S. Mackenzie, K. McKenna

Date: 1980

Prepared by: S. Mackenzie, K. McKenna, S. Davies

Date: 1980 - 1982

Drafted by: Drafting Section, Renewable Resources

Date: 1982

Additional information and maps are available from:

Resource Planning and Management Branch
Department of Renewable Resources
Government of Yukon
Whitehorse, Yukon

Colluvium	SL	GR,CB and ST	Caribou Mountain	Ca 1	O.EB O.DYB	W - M	E.EB D.DYB O.TC	M - I	P	Moderately to Steeply Sloping Fans, Aprons, Veneers	Sw/W-Bt	W-Bt-D/G
				Ca 2	E.EB E.DYB	M - I			A	Moderately to Steeply Sloping Fans, Aprons and Blankets	Sw/W-Bt	
				Ca 3	O.R	W - R			A	Steeply Sloping Fans and Aprons	N.V.	
Morainal and Colluvial Complex	L-SL	GR;CB	Gray Ridge	Gr 1	O.EB O.DYB	W - M	E.EB E.DYB O.SB	M - I	A	Moderately to Steeply Sloping Upper Slope Blankets and Veneers	Sw/W-Bt	Fa/W-Bt
				Gr 2	O.EB E.DYB	I - M	GL.EB GL.DYB O.EB	I - W	A	Moderately Sloping Mid Slope Blankets	Sw/W-Bt	Sw/Fm
				Gr 3	O.HG	I - P	GL.EB R.SC GL.DYB	I - M	P	Seepage Areas in Depressions and on Lower Slopes	W-Bt/Bm	Sb/Lg
				Gr 4	O.TC	W - M	O.EB O.DYB BR.TC	M - W	P	Gently to Moderately Sloping High Mountain Slopes	W-Bt-D/Li	W-Bt-D/G
Bedrock			Rockland	R						Rugged Summits and Rounded Knobs	N.V.	

SOIL TEXTURE

HC	Heavy Clay
C	Clay
SC	Silty Clay
SCL	Silty Clay Loam
CL	Clay Loam
SCL	Sandy Clay Loam
$	Silt
SL	Silt Loam
L	Loam
SL	Sandy Loam
LS	Loamy Sand
FS	Fine Sand
S	Sand
CS	Coarse Sand

DRAINAGE

VR	Very Rapidly
R	Rapidly
W	Well
M	Moderately Well
I	Imperfectly
P	Poorly
VP	Very Poorly

COARSE FRAGMENTS

GR	Gravels
CB	Cobbles
ST	Stones

PERMAFROST

A	Absent
P	Present

SOIL SUBGROUPS

O.MB	Orthic Melanic Brunisol
O.EB	Orthic Eutric Brunisol
E.EB	Eluviated Eutric Brunisol
GL.EB	Gleyed Eutric Brunisol
GLE.EB	Gleyed Eluviated Eutric Brunisol
O.SB	Orthic Sombric Brunisol
O.DYB	Orthic Dystric Brunisol
E.DYB	Eluviated Dystric Brunisol
GL.DYB	Gleyed Dystric Brunisol
O.TC	Orthic Turbic Cryosol
BR.TC	Brunisolic Turbic Cryosol
R.TC	Regosolic Turbic Cryosol
O.SC	Orthic Static Cryosol
BR.SC	Brunisolic Static Cryosol
R.SC	Regosolic Static Cryosol
ME.OC	Mesic Organic Cryosol
TME.OC	Terric Mesic Organic Cryosol
O.HG	Orthic Humic Gleysol
R.HG	Rego Humic Gleysol
O.G	Orthic Gleysol
R.G	Rego Gleysol
O.GL	Orthic Gray Luvisol
T.M	Terric Mesisol
TFI.M	Terric Fibric Mesisol
O.R	Orthic Regosol
GL.R	Gleyed Regosol
GLCU.R	Gleyed Cumulic Regosol
O.HR	Orthic Humic Regosol

VEGETATION COMMUNITIES

W-Bt-D/Li	Willow-Shrub Birch-Dryas/Lichen
W-Bt-D/G	Willow-Shrub Birch-Dryas/Grass
W-Bt/Li	Willow-Shrub Birch/Lichen
W-Bt-D	Willow-Shrub Birch-Dryas
W-Bt	Willow-Shrub Birch
Fa/W-Bt	Alpine Fir/Willow-Shrub Birch
Sw/Eq	White Spruce/Horsetail
Sw/Bm	White Spruce/Bog moss
Sw/Fm	White Spruce/Feathermoss
Sw/Li	White Spruce/Lichen
Sw/W-Bt	White Spruce/Willow-Shrub Birch
Sb/Sp	Black Spruce/Sphagnum
Sb/Lg	Black Spruce/Labrador Tea
Pl/Li	Lodgepole Pine/Lichen
Pl/Ki	Lodgepole Pine/Kinnikinnick
Pt/Ki	Aspen/Kinnikinnick
W/S	Willow/Sedge
W-Bt/Bm	Willow-Shrub Birch/Bog moss
W-Bt/G	Willow-Shrub Birch/Grass
G/Li	Grass/Lichen
N.V.	Non-Vegetated

SOIL LEGEND

GENETIC MATERIAL	SOIL TEXTURE	COARSE FRAGMENTS	SOIL ASSOC./ COMPLEX	SOIL ASSOC. MEMBER	DOMINANT SUB GROUPS	DOMINANT DRAINAGE CLASS	SIGNIF. SUB GROUPS	SIGNIF. DRAINAGE CLASS	PERMA-FROST	TOPOGRAPHY AND LANDFORM	VEGETATION COMMUNITIES DOMINANT	SUBDOM.
Lacustrine Material	SL-L		Champagne	Ch 1	O.EB O.GL	W - M	E.EB GL.EB GLE.EB	M - I	A	Level to Gently Sloping Plains and Terraces	Sw/Fm	Sw/Li
				Ch 2	O.HR O.MB	M - I	O.HR O.EB	M - I	A	Level Plains	W-Bt/G	G/Li
				Ch 3	O.HG R.HG	I - P	O.G R.SC	I - P	P	Depressions and Gently Sloping Lower Slopes	W-Bt/Bm	Sb/Sp
				Ch 4	O.SC	M - VP	BR.SC R.SC	M - VP	P	Valley Bottom Thermo-karst Terrain	W-Bt/Bm	
Lacustrine Morainal Complex	SL-SL	GR;CB	Morley Bay	Mb 1	O.EB	W - M	E.EB	M - I	A	Undulating Blanket Deposits	Sw/Li	Sw/Fm
				Mb 2	E.EB	M - I	O.EB O.HG	I - P	A	Undulating Blanket Deposits	Sw/Fm	Sw/W-Bt
				Mb 3	O.HG R.HG	I - P	O.G BR.SC	I - P	P	Gently Sloping Lower Slopes and Depressions	Sw/Bm	Sb/Sp
Old Alluvium	SL-S	GR;CB	Sterlin	St 1	O.EB O.DYB	W - M	E.DYB E.EB O.SB	M - I	A	Fans, Blankets, Terr-aces and Plains	Sw/W-Bt	Sw/Li
				St 2	E.EB E.DYB	M - I	O.HG GL.EB GL.DYB	P - I	A	Low Lying Fans and Plains	Sw/Fm	Sw/W-Bt
Recent Alluvium	SL-SL		Wheaton River	Wt 1	R.G	VP - P	O.R O.G GL.R	I - P	A	Level Plains Subject to Annual Flooding	W/S	Sw/W-Bt
				Wt 2	O.HG O.G	P - I	O.HR GL.R R.G	I - P	A	Level Plains Subject to Occasional Flooding	W-Bt/Bm	Sw/W-Bt
Alluvial And Organic	SL		Nisutlin	Ns 1	R.G GL.R	P - I	T.M TME.OC GLCU.R	VP - P	P	Level Alluvial Flood-plains	Sw/Eq	W/S
				Ns 2	T.M TME.OC	VP - P	R.G GL.R	P - I	P	Level Alluvial Flood-plains	W-Bt/Bm	Sb/Sp
Organic Material			Tenmile Creek	Tn 1	T.M	P	ME.OC	P - VP	P	Mid Slope Depressions	W-Bt/Bm	
				Tn 2	TFI.M	P - VP	T.M TME.OC	P - VP	P	Lower Slopes and Depressions	Sw/W-Bt	Sb/Sp
Eolian Material	LS-S		Carcross	Cs 1	O.R	VR			A	Active Dunes	N.V.	Pt/Ki
				Cs 2	O.DYB O.EB	VR - R	O.R	VR - R	A	Stabilized Dunes	Pl/Ki	Pl/Li
Glacio-fluvial Material	LS-S	GR;CB	Judas Creek	Jd 1	O.EB O.DYB	R - W	E.EB E.DYB O.MB	M - I	A	Hummocky, Ridged and Pitted Plains and Terraces	Sw/Li	Pl/Ki
				Jd 2	E.EB	M - I	E.DYB GLE.EB	I - P	A	Depressions in Hummocky and Ridged Terrain	Sw/Fm	
Glacio-fluvial and Morainal Complex	L-S	GR;CB	Brooks Brook	Bb 1	O.EB O.DYB	R - M	E.EB E.DYB	M - I	A	Slopes with Isolated Ridges; Old Shallow Channels and Terraces	Sw/W-Bt	Sw/Li
				Bb 2	E.EB E.DYB	M - I	O.EB O.DYB	W - M	A	Gently to Moderately Sloping Blankets with Isolated Ridges and Terraces	Sw/Fm	Sw/W-Bt
				Bb 3	O.G O.HG	I - P	R.SC	I - P	P	Lower Seepage Slopes with Isolated Ridges	Sw/W-Bt	Sb/Sp
Morainal Material	L-SL	GR;CB	Watson River	Ws 1	O.EB O.DYB	W - M	E.EB E.DYB O.SB	M - I	A	Gently to Moderately Sloping Plains, Blank-ets and Veneers	Sw/Li	W-Bt
				Ws 2	E.EB E.DYB	M - I	GL.EB GL.DYB O.EB	I - W	A	Gently to Moderately Sloping Blankets and Plains	Sw/Fm	Sw/W-Bt
				Ws 3	O.HG	I - P	GL.EB GL.DYB R.SC	I - M	P	Seepage Areas in De-pressions and on Lower Slopes	Sw/W-Bt	Sb/Lg
				Ws 4	O.TC	W - M	O.EB O.DYB BR.TC	M - W	P	Gently Sloping Veneers on High Mountains	W-Bt/Li	W-Bt-D
Neoglacial Morainal Material	SL-S	GR,CB and ST	Tally-Ho Mountain	Th 1	O.R R.TC	M - W	O.DYB O.TC	M - W	P	Hummocky Cirque Floors	W-Bt-D/Li	W-Bt-D/G
Colluvium	SL	GR,CB and ST	Caribou Mountain	Ca 1	O.EB O.DYB	W - M	E.EB D.DYB O.TC	M - I	P	Moderately to Steeply Sloping Fans, Aprons, Veneers	Sw/W-Bt	W-Bt-D/G
				Ca 2	E.EB E.DYB	M - I			A	Moderately to Steeply Sloping Fans, Aprons and Blankets	Sw/W-Bt	
				Ca 3	O.R	W - R			A	Steeply Sloping Fans and Aprons	N.V.	
Morainal and Colluvial Complex	L-SL	GR;CB	Gray Ridge	Gr 1	O.EB O.DYB	W - M	E.EB E.DYB O.SB	M - I	A	Moderately to Steeply Sloping Upper Slope Blankets and Veneers	Sw/W-Bt	Fa/W-Bt
				Gr 2	O.EB E.DYB	I - M	GL.EB GL.DYB O.EB	I - W	A	Moderately Sloping Mid Slope Blankets	Sw/W-Bt	Sw/Fm
				Gr 3	O.HG	I - P	GL.EB R.SC GL.DYB	I - M	P	Seepage Areas in De-pressions and on Lower Slopes	W-Bt/Bm	Sb/Lg
				Gr 4	O.TC	W - M	O.EB O.DYB BR.TC	M - W	P	Gently to Moderately Sloping High Mountain Slopes	W-Bt-D/Li	W-Bt-D/G
Bedrock			Rockland	R						Rugged Summits and Rounded Knobs	N.V.	

SOIL TEXTURE

HC	Heavy Clay
C	Clay
SC	Silty Clay
SCL	Silty Clay Loam
CL	Clay Loam
SCL	Sandy Clay Loam
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SL	Silt Loam
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LS	Loamy Sand
FS	Fine Sand
S	Sand
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COARSE FRAGMENTS

GR	Gravels
CB	Cobbles
ST	Stones

SOIL SUBGROUPS

O.MB	Orthic Melanic Brunisol
O.EB	Orthic Eutric Brunisol
E.EB	Eluviated Eutric Brunisol
GL.EB	Gleyed Eutric Brunisol
GLE.EB	Gleyed Eluviated Eutric Brunisol
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O.DYB	Orthic Dystric Brunisol
E.DYB	Eluviated Dystric Brunisol
GL.DYB	Gleyed Dystric Brunisol
O.TC	Orthic Turbic Cryosol
BR.TC	Brunisolic Turbic Cryosol
R.TC	Regosolic Turbic Cryosol

VEGETATION COMMUNITIES

W-Bt-D/Li	Willow-Shrub Birch-Dryas/Lichen
W-Bt-D/G	Willow-Shrub Birch-Dryas/Grass
W-Bt/Li	Willow-Shrub Birch/Lichen
W-Bt-D	Willow-Shrub Birch-Dryas
W-Bt	Willow-Shrub Birch
Fa/W-Bt	Alpine Fir/Willow-Shrub Birch
Sw/Eq	White Spruce/Horsetail
Sw/Bm	White Spruce/Bog moss
Sw/Fm	White Spruce/Feathermoss
Sw/Li	White Spruce/Lichen

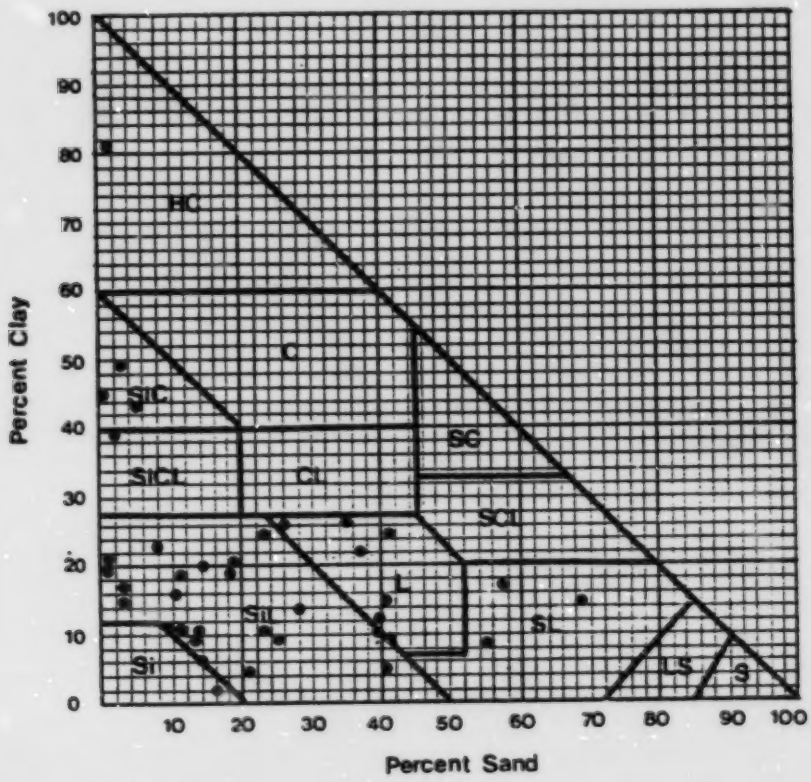


Figure 9 Texture of lacustrine material - Champagne Association

lacustrine deposits tend to be stratified and laminated, with varves commonly found in the upper 5 to 10 metres.

Lacustrine deposits are often capped with a thin mantle of loess or eolian sand which can vary from a few centimetres to 50 cm thick. The occurrence of wind-blown material is difficult to map from air photos, but it directly affects the soil development on lacustrine deposits. Where wind-blown materials occur, and on well tc moderately well drained loamy lacustrine deposits, Orthic Eutric Brunisol is the dominant soil and White Spruce/Lichen, the dominant vegetation community Orthic Eutric Brunisol is the most common soil found on lacustrine material.

However, where wind-blown material is absent on silt and clay lacustrine deposits, Orthic Gray Luvisol is the dominant soil. These soils are found on well and moderately well-drained plains and valley benches, commonly associated with a White Spruce/Feathermoss community. Table 2 (Appendix H) describes the profile and characteristics of a typical well-drained Orthic Gray Luvisol occurring under a Lodgepole Pine/Kinnikinnick community on a gently southerly sloping (9%) valley floor.

Common associates of the Champagne Association include Orthic Melanic Brunisol soils which occur on moderately well-drained shrublands or grasslands. The topography is generally level to slightly sloping (Plate 2). Morphologically, these soils are similar to an Orthic Dark Gray Chernozem but do not meet the climate criterion specifying a minimum of 0°C mean annual temperature for Chernozems. Thus, these soils are classified as Orthic Melanic Brunisol under the Canadian System of Soil Classification.

Additional common associates include Gleyed Humic Regosol and Orthic Humic Regosol soils. Parent material is calcareous and may be slightly saline. These soils occur on level to gently sloping lacustrine plains, on moderately well to imperfectly drained sites with Willow-Shrub Birch/Grass as the dominant vegetation community.

On imperfectly to poorly drained plains, depressions, and seepage slopes additional associates such as Orthic Humic Gleysol, Orthic Gleysol, and Rego Humic Gleysol occur. The dominant vegetation communities include Willow-Shrub Birch/Bog moss and Black Spruce/Bog moss. Seepage slopes mantled with lacustrine deposits, often on north aspects are occasionally frozen with Regosolic Static Cryosol occuring associated with shallow active layers.

Permafrost is also found in active thermokarst areas. These areas can be identified by distinctive roundish ponds with collapsing banks where melting of ground ice is occuring. Generally, the active layer is usually between 1.0 and 1.5 metres deep. Typical soil associates in thermokarst areas include Orthic Static Cryosol, Brunisolic Static Cryosol and Regosolic Static Cryosol (Plate 3).

Minor associates of the Champagne Association include Gleyed and/or Eluviated Eutric Brunisol soils. These soils occur on gentle slopes under mixed forest cover. On flat dried lake beds occupied by clumps of salt-tolerant plants Orthic Regosol and Orthic Luvic Gleysol saline phase, are found. However, these areas are usually too small to be mapped as separate units.

Typically, the material of the Champagne Association is stone-free. However, local areas may have lacustrine deposits containing 10-20% subrounded gravel and cobbles. Minor soil associates on these deposits are Orthic Eutric Brunisol, stony phase and Orthic Gray Luvisol, stony phase.

A schematic cross-section illustrating the general distribution of Champagne soils and vegetation communities which may occur in these soils is presented in Figure 10.

5.2.2 Morley Bay Association

Morley Bay Complex Association includes those soils developed on a complex of lacustrine and morainal deposits found in the vicinity of major existing lakes (Plate 4). They are most extensive along the shores of Teslin and Tagish Lakes. In these areas, the mantle of lacustrine deposit on till is very variable, thus the distinction between lacustrine and till deposits on air photos is difficult. These deposits are found on gently sloping to undulating plains below 900 m (3000') a.s.l. Slopes range from 0 to 30% and local relief is 5-10 m. The material usually ranges in texture from silt loam to sandy loam with up to 50% gravel and cobbles. A discontinous layer of loess or eolian sand is often found on the surface, but it is usually less than 30 cm thick.

The major associate of the Morley Bay Complex is Orthic Eutric Brunisol which occurs on well to moderately well-drained plains or slopes associated with White Spruce/Lichen or White Spruce/Feathermoss communities. Table 3 (Appendix H) describes the profile and parent material characteristics of a well drained Orthic Eutric Brunisol found under a White Spruce/Feathermoss vegetation community on a level plain.

Eluviated Eutric Brunisol is a common associate of the Morley Bay Complex. This soil occurs in imperfectly to moderately well-drained areas, under forests of White Spruce/Feathermoss or White Spruce/Willow-Shrub Birch. An additional common soil associate is Orthic Humic Gleysol found in depressions and at the base of slopes. One may find minor occurrences of Regosolic Static Cryosol on poorly drained lower slopes under imperfect to poor drainage conditions.

A schematic cross-section illustrating the physiographic setting of Morley Bay Complex soils and associated vegetation communities is presented in Figure 11.

5.2.3 Sterlin Association

Sterlin Association consists of soils developed on older, established alluvial plains, fans and terraces along valley sides. These landforms are very common at the base of slopes in valleys of the Coast Mountains, as well as along the banks of major rivers and shores of large lakes. The topography is usually level to gently sloping (0-20%), and local relief seldom exceeds 10 m (Plate 5). In general, older alluvial deposits are only found below 1050 m (3500') a.s.l. Soils of the Sterlin Association are not usually subject to river flooding. The texture of the parent material is usually between sandy loam and sand (Figure 12) and may contain up to 70% subrounded to rounded gravel and cobbles. Occasional boulders may be present. The parent material is non calcareous, friable to loose, and moderately to rapidly pervious. The material can be either stratified or massive.

The dominant associate of Sterlin Association is an Orthic Eutric Brunisol. This soil occurs on well-drained alluvial terraces or plains under White Spruce/Willow-Shrub Birch or White Spruce/Lichen communities. Profile

Fig.10

Schematic Profile of Champagne Association

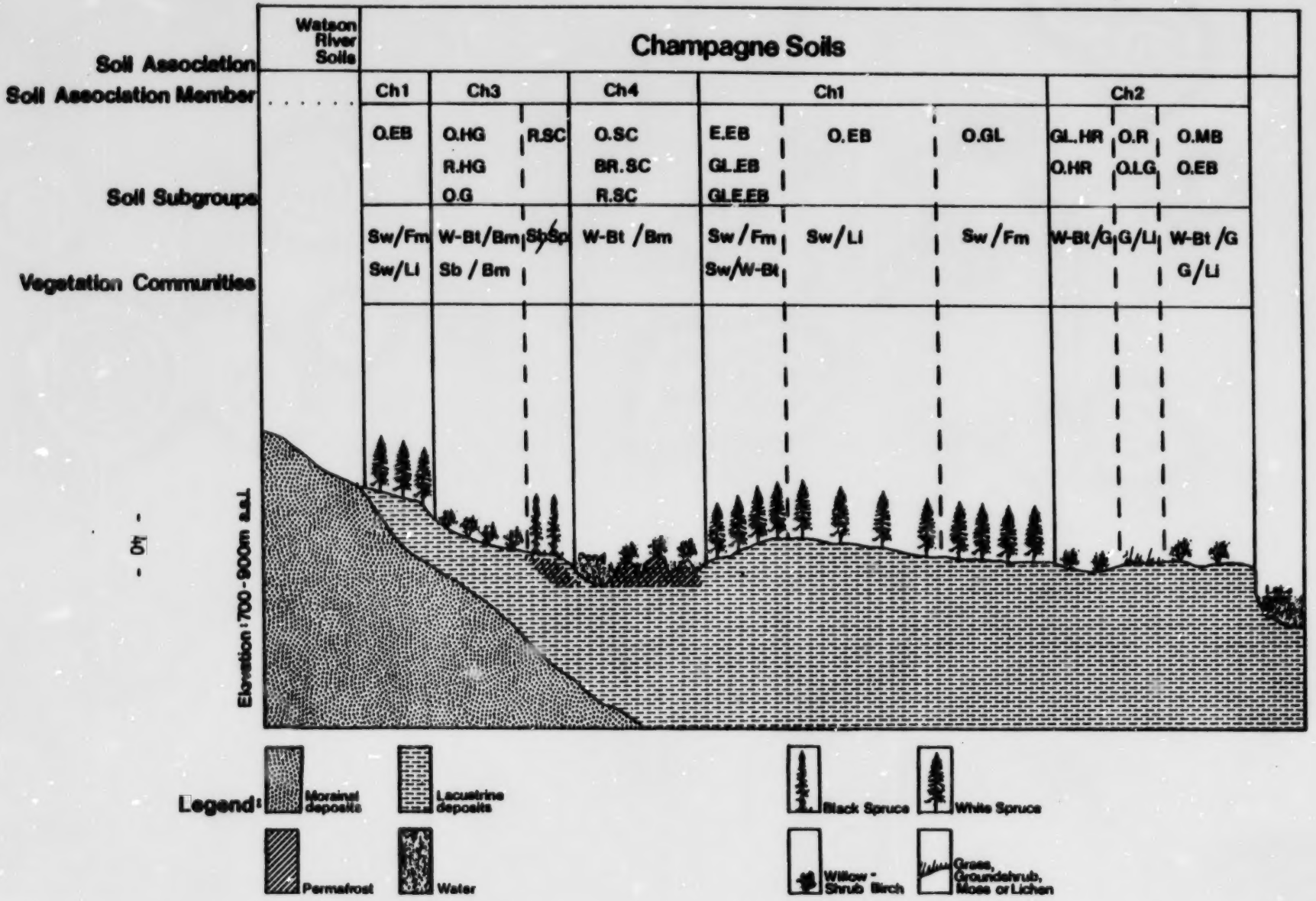
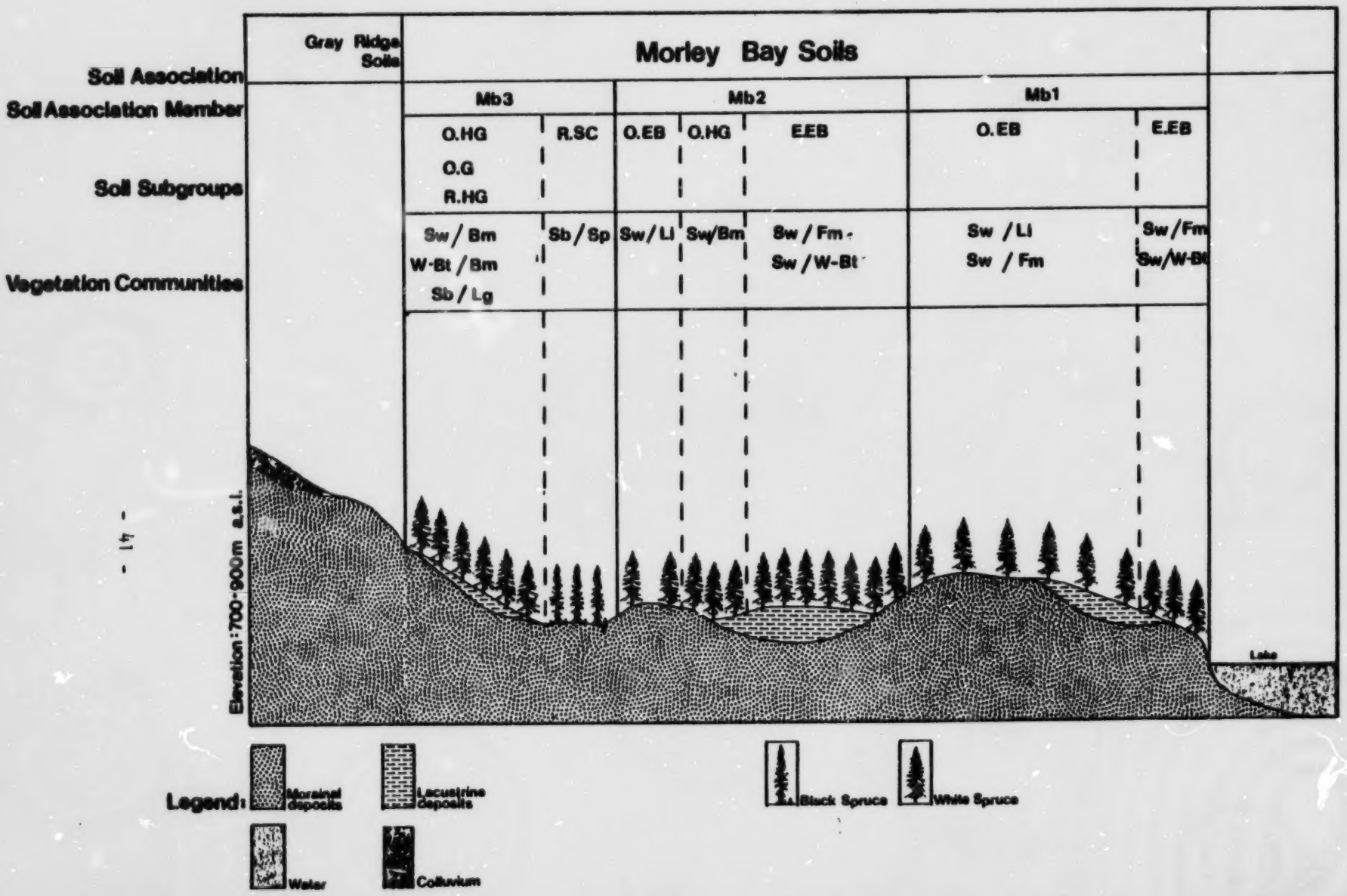


Fig.11

Schematic Profile of Morley Bay Complex Association



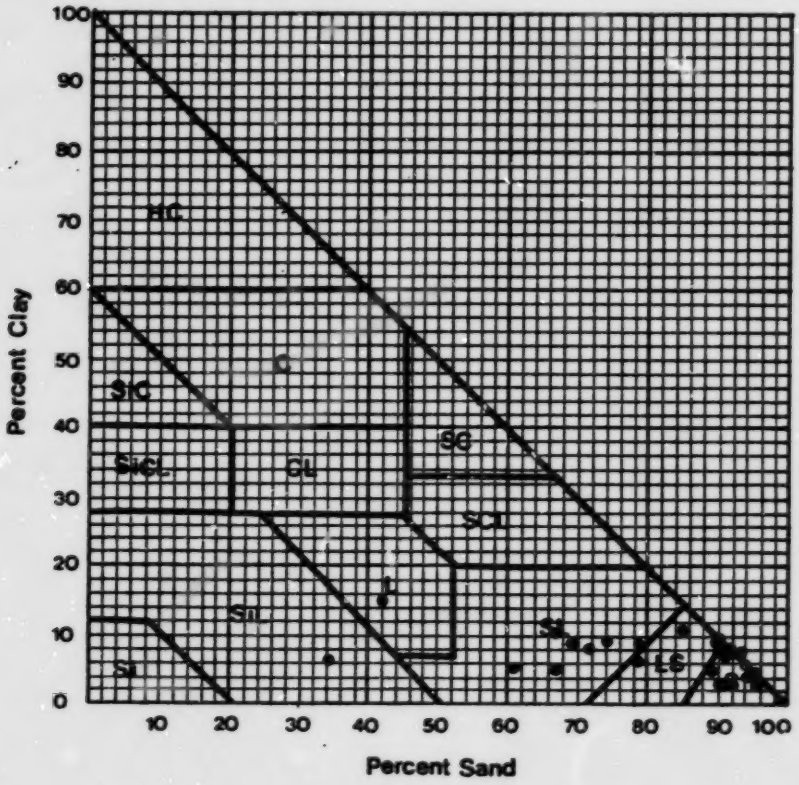


Figure 12 Texture of Alluvial Material - Sterlin Association

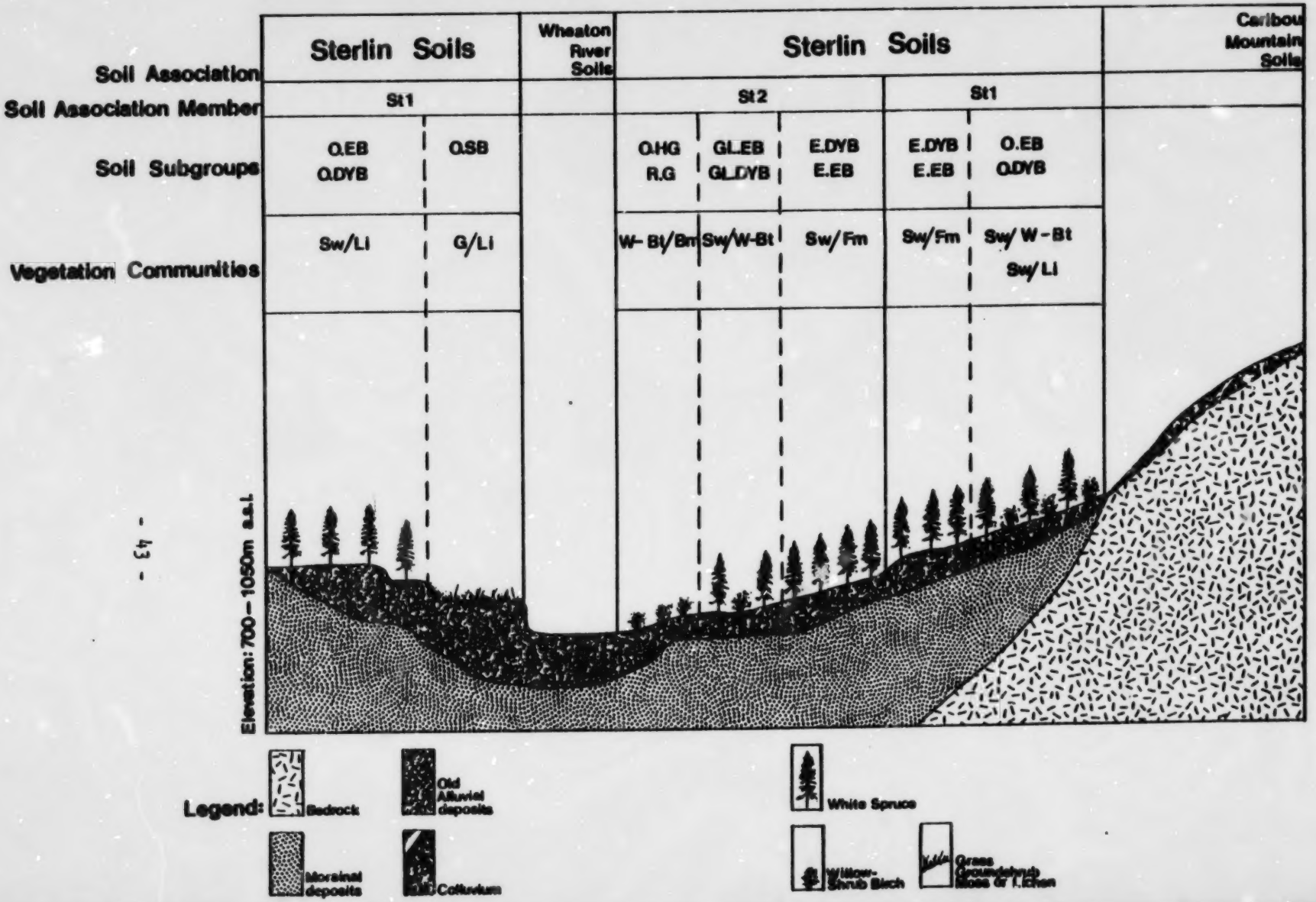
description and characteristics of an Orthic Eutric Brunisol found on a level fan are in Table 4 (Appendix H).

Significant members of Sterlin Association are Orthic Dystric Brunisol, Orthic Sombric Brunisol and Orthic Humic Gleysol soils. Orthic Dystric Brunisol soils are found under similar conditions to Orthic Eutric Brunisol soils. Eluviated Eutric and Dystric Brunisol soils are found on moderately well or imperfectly drained sites. They usually associate with White Spruce/Feathermoss communities.

Orthic Sombric Brunisol soils are found under Grass/Lichen communities. They occur most often on moderately well-drained plains and in old river channels. Orthic Humic Gleysol is found in poorly drained areas on lower slopes and in depressions of alluvial fans, blankets and terraces. These soils commonly associate with Willow-Shrub Birch/Bog moss communities.

Fig.13

Schematic Profile of Sterlin Association



Minor associates of the Sterlin Association include Rego Gleysol and Gleyed Eutric Brunisol soils found under poor and imperfect drainage conditions, respectively. A schematic cross-section illustrating the distribution of Sterlin soils and vegetation communities is presented in Figure 13.

5.2.4 Wheaton River Association

Wheaton River Association includes those soils developed on recent alluvial deposits within active floodplains of rivers. These soils are generally found below 1000 m (3300') a.s.l. along creek and river valleys throughout the study area. The parent material has a textural range from clay loam to sandy loam (Figure 14), is moderately to slowly pervious, firm to loose, and non to weakly calcareous. Though the material is often stone free, up to 50% gravel and cobbles may be present. The alluvium may be massive or stratified. The type and degree of soil development is related to the texture and age of the material, frequency of flooding and depth to the water table.

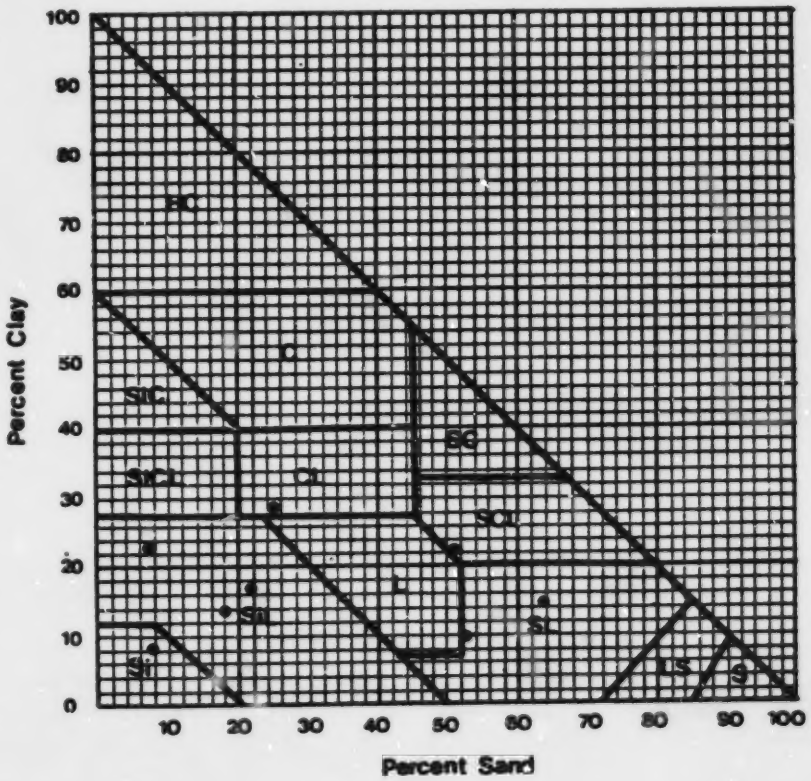


Figure 14 Texture of Alluvial Material - Wheaton River Association

The dominant subgroups of Wheaton River Association are Orthic Gleysol, Rego Gleysol and Orthic Humic Gleysol. Orthic Gleysol soils are found in poorly to imperfectly drained areas subject to occasional flooding, often associated with White Spruce/Willow-Shrub Birch communities. Table 5 (Appendix H) presents the profile description and parent material characteristics of an Orthic Gleysol. The site is imperfectly drained, and the dominant vegetation community is Willow/Willow. Rego Gleysol soils are found in imperfect to very poorly drained locations subject to annual flooding (Plate 6). Puddles and barren surfaces are common on these soils. The dominant vegetation communities are Willow/Sedge/Wetland moss. Orthic Humic Gleysol is a poorly drained associate which is flooded only in years of unusually high water. Infrequent flooding permits the growth of a thick moss carpet and the development of humus layer in the soil (Plate 7). A common vegetation community is Willow-Shrub Birch/Bog moss.

Common members of the Wheaton River Association include Gleyed Regosol, Orthic Regosol, Orthic Humic Regosol and Gleyed Cumulic Regosol. These are imperfectly drained soils.

A schematic cross-section illustrating the distribution of Wheaton River soils and vegetation communities is presented in Figure 15.

5.2.5 Nisutlin Complex Association

Nisutlin Complex Association is comprised of organic and mineral soils which occur on the floodplains of meandering rivers on broad valley floors. The floodplain of the Nisutlin River is the largest area mapped in this complex association. The meandering river has created a patch-work of mineral and organic landforms on the valley floor. The floodplain is dominated by marshes, fens, alluvial flats and bars. The topography is level to gently sloping (0-10% slope). Local relief seldom exceeds 10 m. In general, these soils are found below 750 m (2500') a.s.l. (Plate 8).

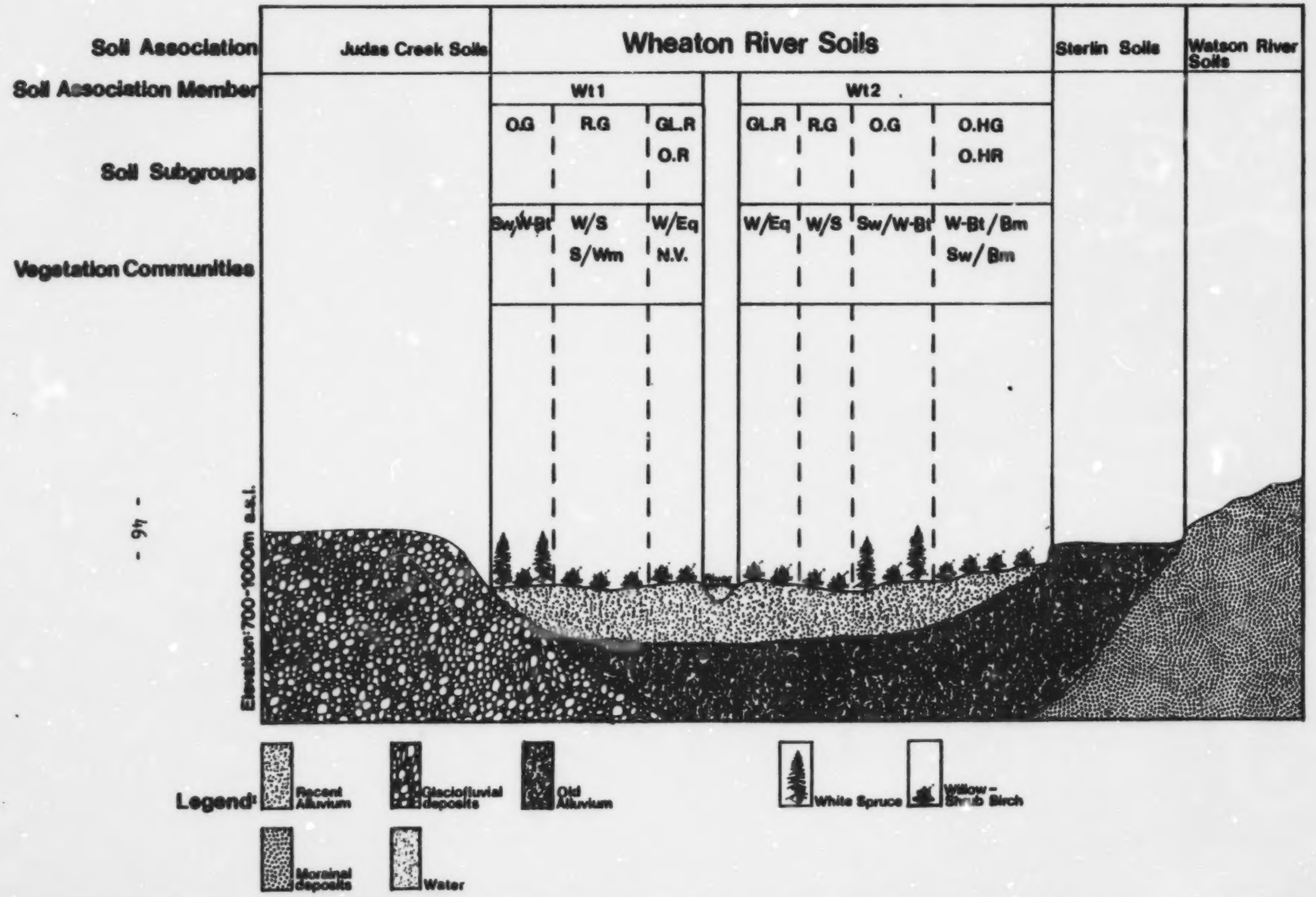
The mineral soils derived from alluvial sediments are found in marshes, bars and flats. These soils are subject to annual and frequent periodic flooding, and are similar to the soils found in the Wheaton River Soil Association.

The major subgroups in these imperfectly to very poorly drained soils are Gleyed Regosol, Rego Gleysol and Gleyed Cumulic Regosol. These associates are about equally dominant in terms of their distribution. Gleyed Regosol is usually found along the river banks associated with White Spruce/Equisetum or Willow/Equisetum communities. Rego Gleysol is usually associated with Willow/Sedge/Wetland moss. Gleyed Cumulic Regosol is found farther away from the river channels and is also associated with Willow/Sedge communities.

Organic soils are found in fens and local areas of palsas and peat plateaus occupying abandoned river channels. The drainage is very poor in the fens and the organic layer consists of 60-100 m of mesic sedge peat overlying gleyed silty alluvial sediments. The major associate on organic soils is a Terric Mesisol and the dominant vegetation community is Willow-Shrub Birch/Bog moss.

Fig.15

Schematic Profile of Wheaton River Association



Associated with the fens are palsas and peat plateaus which rise 60-100 cm above the water level of the surrounding surface. These palsas and peat plateaus are composed of 40-60 cm of mesic forest and sphagnum peat overlying permafrost (frozen peat and mineral soil). A common associate of palsas and peat plateaus is classified as Terric Mesic Organic Cryosol and the typical vegetation community is Black Spruce/Sphagnum. Where the flow of surface water has eroded palsas and peat plateaus, collapsed banks of the organic landform can be seen.

Figure 16 presents a schematic cross-section illustrating the distribution of soils and vegetation communities found in the Nisutlin Complex Soil Association.

5.2.6 Tenmile Creek Association

Organic deposits, within the study area, occur in poor to very poorly drained depressions on mid-mountain slopes, seepage areas on lower slopes and at the base of meltwater channels. Shallow, usually less than 1.5 m, organic soils found in these areas belong to the Tenmile Creek Association.

In general, organic deposits on mid-slopes, usually between 1000 m (3300') and 1300 m (4300') a.s.l., occur in small fens several hectares in size. These are shrubby, fen peat deposits 90 to 150 cm thick overlying undifferentiated mineral material (Plate 9). Permafrost is usually absent but some frozen mounds do occur. Seasonal frost is often present throughout the summer months. Below 1000 m (3300') a.s.l., there are some discontinuous peat deposits 40 to 100 cm thick overlying mineral material on poorly drained seepage slopes. These are often intermediate between fen and bog wetland forms, sphagnum moss being a major component of the ground cover overlying mesic sedge and moss peat (Plate 10). The pH of the surface water is usually between medium acid and neutral. Permafrost is found in sporadic pockets, with an active layer of 40-50 cm.

Terric Mesisol is the major sub-group in the Tenmile Creek Association. The wetland form is usually a shrubby fen and the soil consists of moderately decomposed sedge and moss peat. A profile description of this soil is presented in Table 6 (Appendix H). The site is on a poorly drained lower slope with the water table around 45 cm. The vegetation community at this site is Willow-Shrub Birch/Bog moss.

Common associates of Tenmile Creek Association include Terric Mesic Fibrisol and Terric Mesic Organic Cryosol. Terric Mesic Fibrisol soils are found in bog veneers in lower slopes and foothills below 1000 m a.s.l. under poor to very poor drainage conditions. Terric Mesic Fibrisol is usually associated with White Spruce/Bog moss or Black Spruce/Bog moss communities. Terric Mesic Organic Cryosol soils are found on poorly drained lower slopes, in mounds, which rise 60-70 cm above the surrounding area. These mounds contain frozen mineral cores which are often ice-rich. Black Spruce/Sphagnum is the most common vegetation community.

A schematic cross-section illustrating the distribution of Tenmile Creek soils and vegetation is presented in Figure 17.

Fig.16

Schematic Profile of Nisutlin Complex Association

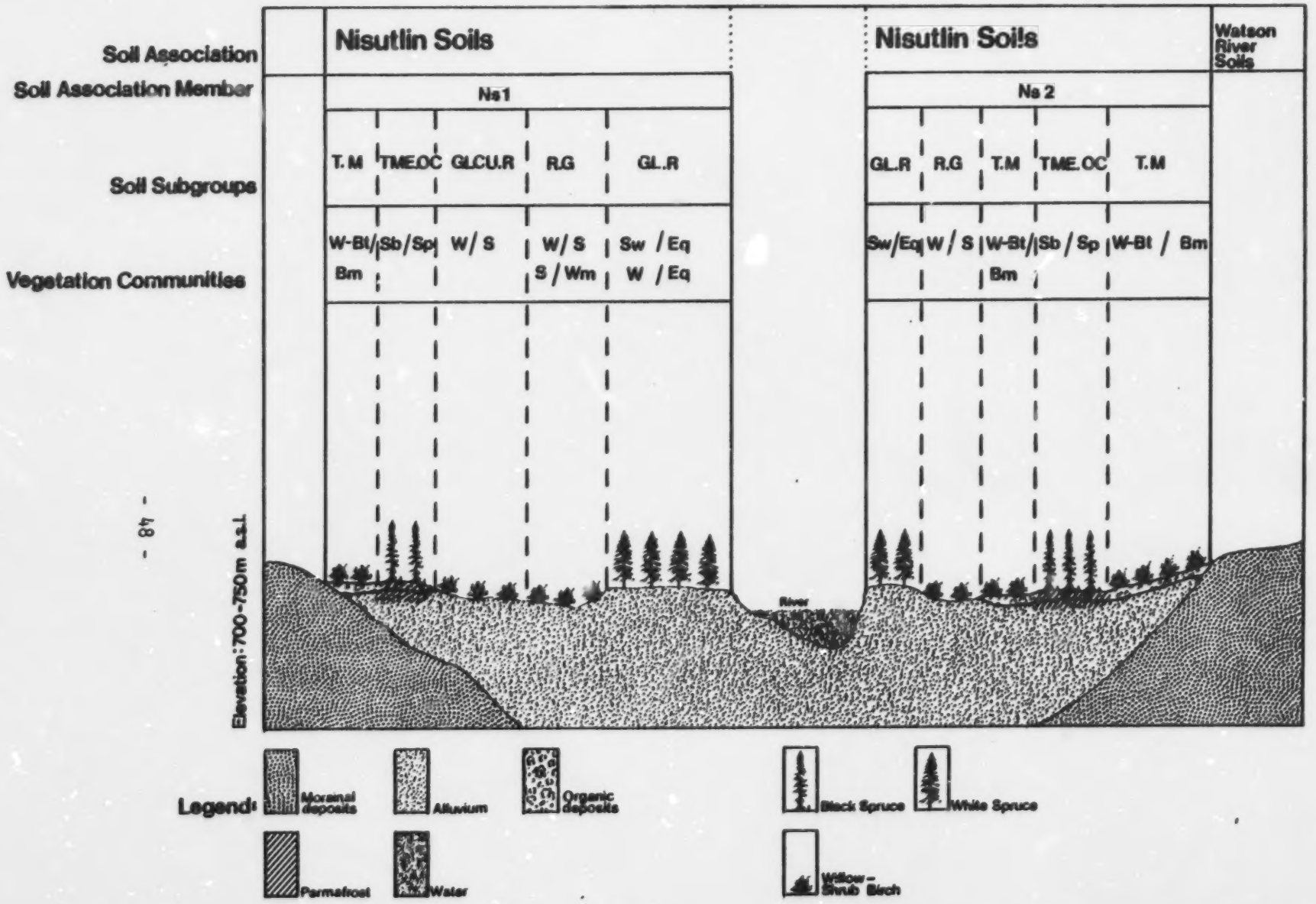
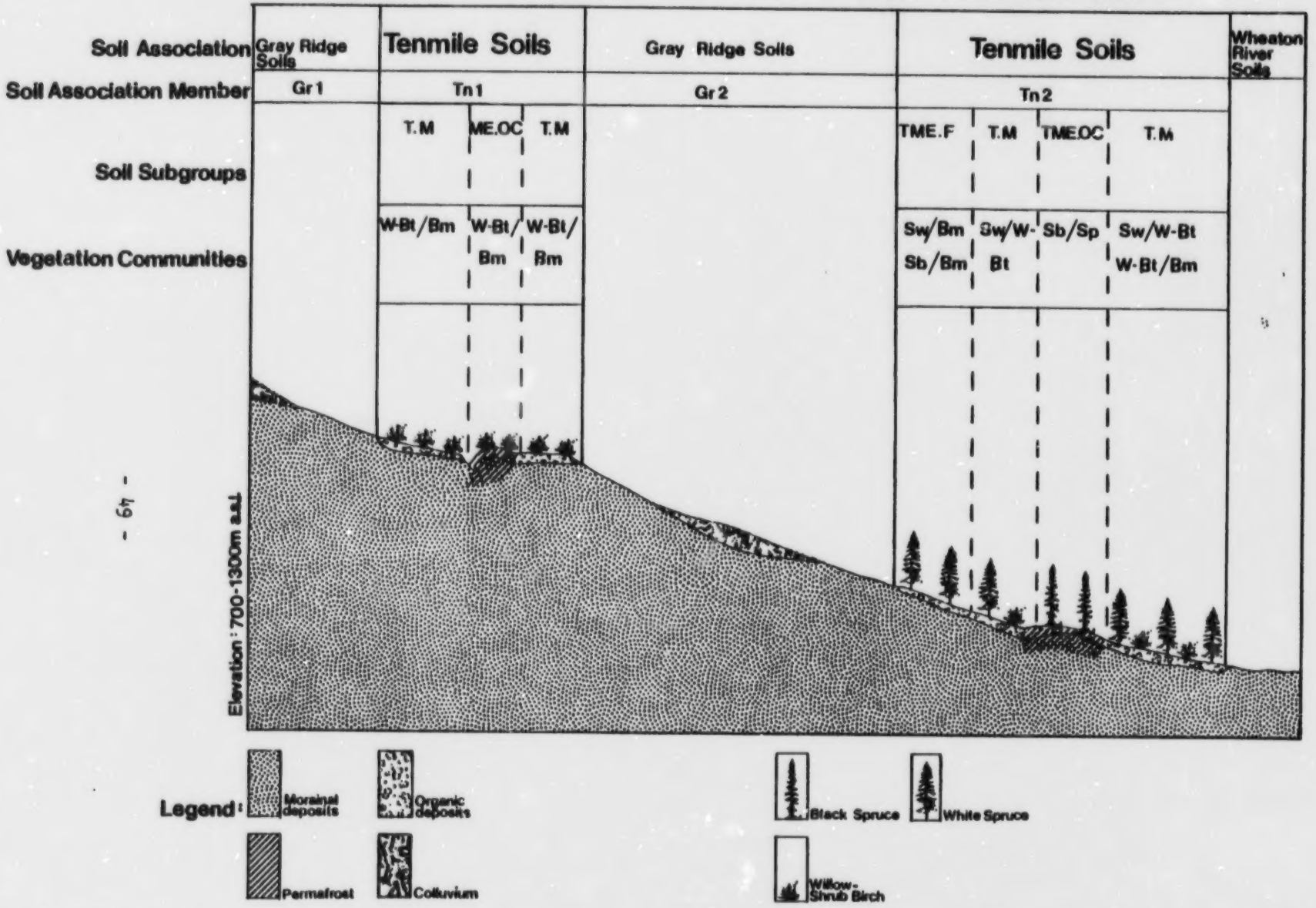


Fig.17

Schematic Profile of Tenmile Creek Association



5.2.7 Carcross Association

Carcross Association is comprised of soils developed on thick eolian sand deposits. Sand dunes are not common within the study area but they occupy local areas below 1000 m (3300') a.s.l. The two most extensive eolian deposits (Plate 11) are located south of Lake Laberge and at Carcross.

The dunes are usually parabolic in shape and they form moderate to steep hills with slopes ranging from 10 to 30%. Local relief is 10-30 metres. The parent material has a dominant textural range of loamy sand to sand (Figure 18) and is generally loose, rapidly pervious, stone free and noncalcareous. Near Lake Laberge eolian sand deposits 2-10 cm thick are underlain by lacustrine silt and clay deposits. The weakly developed solum often shows signs of redeposition by wind activity.

Orthic Regosol is the major soil on active sand dunes. These areas have very sparse vegetation and are extensively barren. Scattered aspen and low shrubs manage to grow on the lee side of the dunes. These soils are very rapidly drained and the vegetation suffers from moisture deficiency during parts of the growing season. Profile descriptions and parent material characteristics

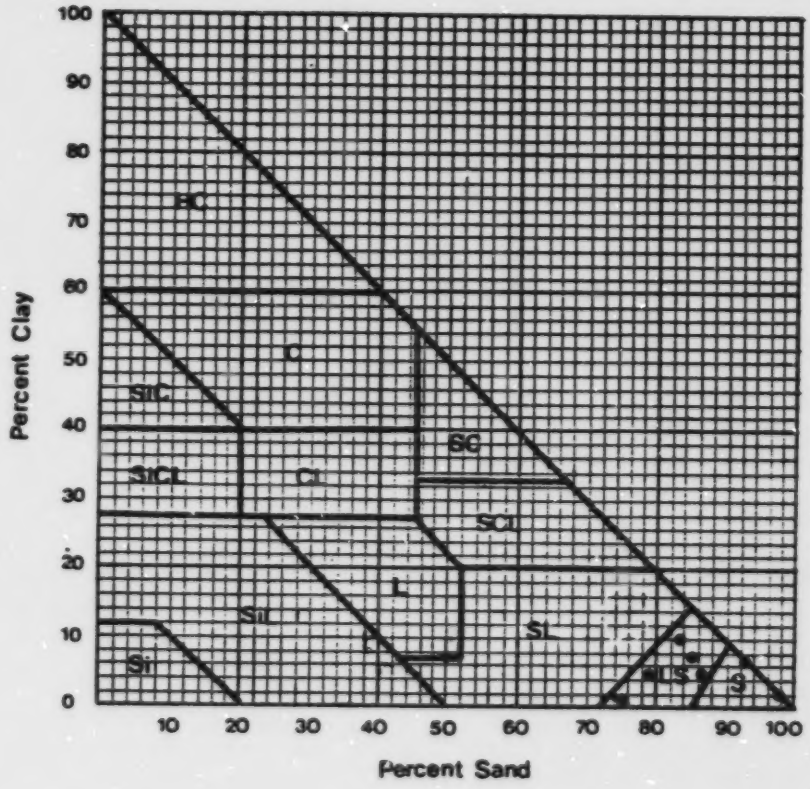


Figure 18 Texture of Eolian Material - Carcross Association

of an Orthic Regosol on a 3% southwest slope are outlined in Table 7 (Appendix H).

Stabilized dunes have a fairly continuous forest cover consisting of Lodgepole Pine/Lichen, Lodgepole Pine/Kinnickinnick or White Spruce/Lichen communities. The common soil associate on stabilized dunes is an Orthic Dystric or Orthic Eutric Brunisol. These soils are very rapidly to rapidly drained, and they may have a solum depth of 40 cm.

A schematic cross-section illustrating the distribution of Carcross soils and vegetation is presented in Figure 19.

5.2.8 Judas Creek Association

Judas Creek Association consists of soils developed on glaciofluvial outwash and ice-contact surficial materials. Outwash deposits are proglacial deposits of sorted sand and gravels. These deposits occur on gently sloping or undulating plains and terraces, with slopes ranging from 5 to 30%. These glaciofluvial deposits are found between 720 and 1000 m (2400-3300') a.s.l. Local relief is 5-10 m. Ice-contact glaciofluvial deposits are composed of stratified to poorly sorted sand, gravel, cobbles and boulders. Typical landforms include eskers, kames and kettles on rolling and hummocky terrain with local relief of 20-30 m. Ice-contact deposits occur between 800 to 1000 m (2700-3300') a.s.l. (Plate 12).

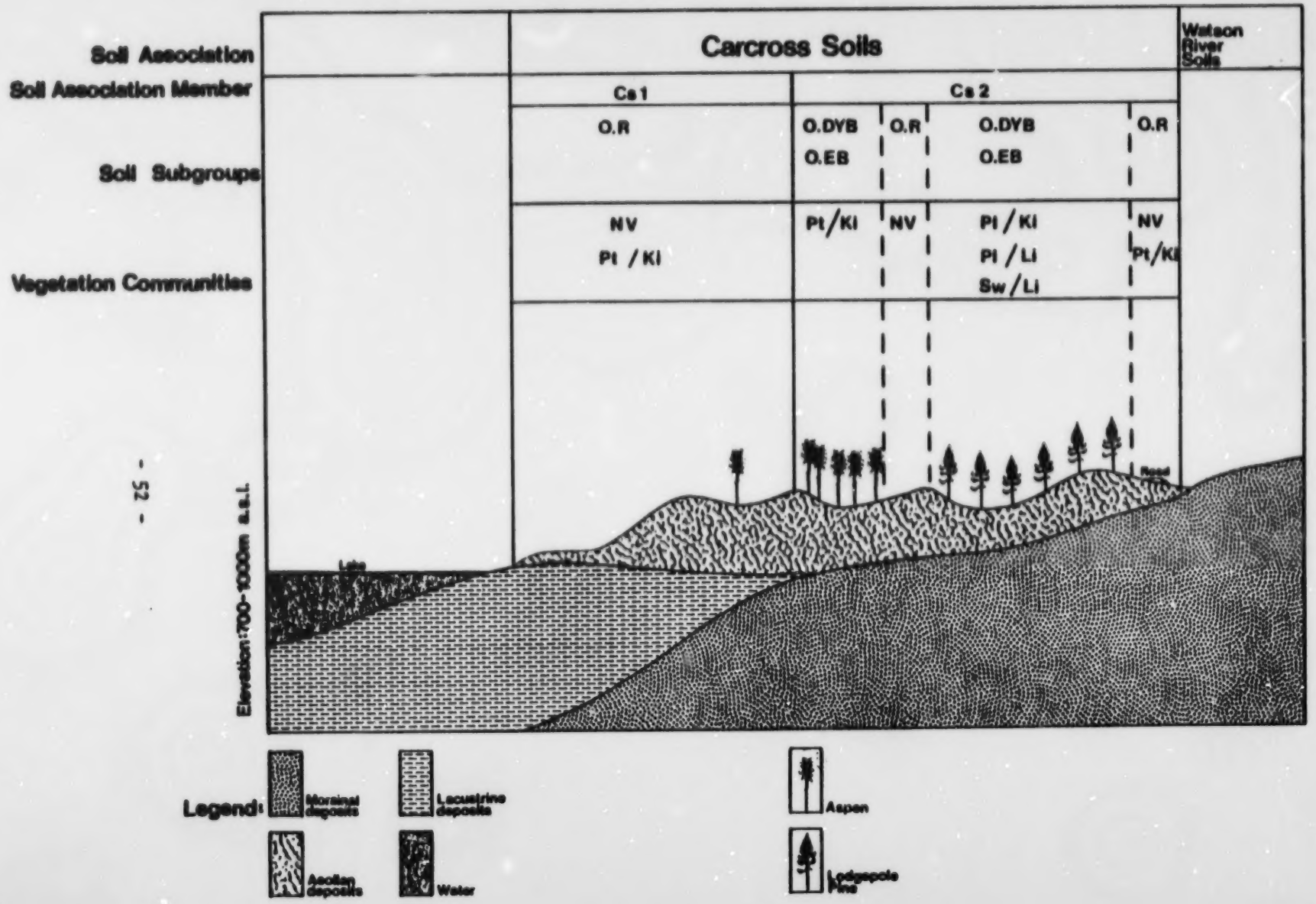
The parent material has a textural range from silt loam to sand (Figure 27) with loamy sand and sand appearing to be the more common textures. It is generally loose, rapidly pervious, non-calcareous to weakly calcareous and usually contains between 20 and 70% gravel, cobbles, and some boulders.

Glaciofluvial deposits are most extensive in major valleys such as along the Yukon River between Marsh Lake and Whitehorse, the Squanga-Michie Valley and the Atlin Valley. Smaller glaciofluvial plains, terraces, and kames and esker complexes are found throughout the map area.

Below 900 m (3000') a.s.l., a discontinuous layer of loess or eolian sand up to 50 cm thick often covers glaciofluvial deposits. However, at higher elevations the wind blown material usually thins out or disappears all together.

The major soil associates are Orthic Dystric Brunisol and Orthic Eutric Brunisol. These soils are both widespread but as they occur under similar site conditions, they cannot be separated at the present scale of mapping. Orthic Dystric and Eutric Brunisol soils occur on well to rapidly drained sites. Typically the vegetation consists of White Spruce/Lichen and White Spruce/Kinnickinnick communities, though Lodgepole Pine is common due to frequent fires and low moisture holding capacity of the soil. Moisture deficiency may exist in the soil for parts of the growing season. Profile descriptions and physical and chemical characteristics of an Orthic Dystric Brunisol on a 5% southeast slope of an outwash plain are presented in Table 8 (Appendix H). The vegetation community is Lodgepole Pine/Lichen.

Fig.19
Schematic Profile of Carcross Association



Common associates of Judas Creek Association include Eluviated Dystric and Eluviated Eutric Brunisols. These are moderately to imperfectly drained soils found on lower slopes and in depressions of kame and esker complexes. The dominant vegetation community is commonly White Spruce/Feathermoss. On moisture deficient southfacing slopes or ridges, one often finds well to rapidly drained Orthic Melanic and Sombric Brunisols under grassland vegetation.

In kettles and depressions of esker complexes, minor associates such as Gleyed Regosol and Gleyed Eluviated Dystric and Eutric Brunisols are found. These soils occur under White Spruce/Feathermoss communities but are limited to local distribution. Another associate of Judas Creek Association is an Orthic Regosol which occurs in areas actively deflated by wind. These rapidly drained soils have very poor solum development.

A schematic cross-section illustrating the distribution of Judas Creek soils is presented in Figure 21.

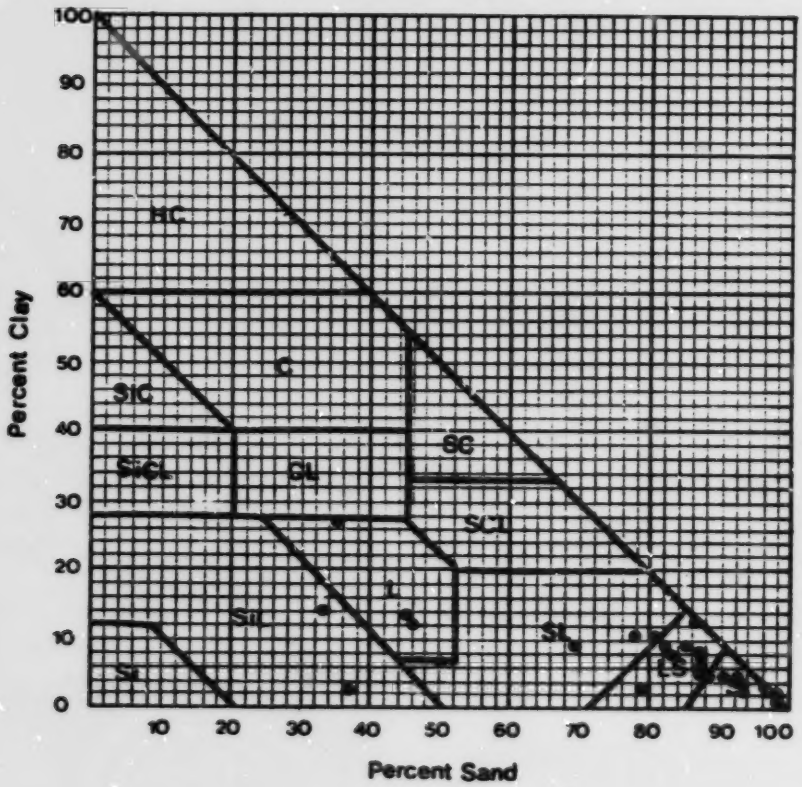
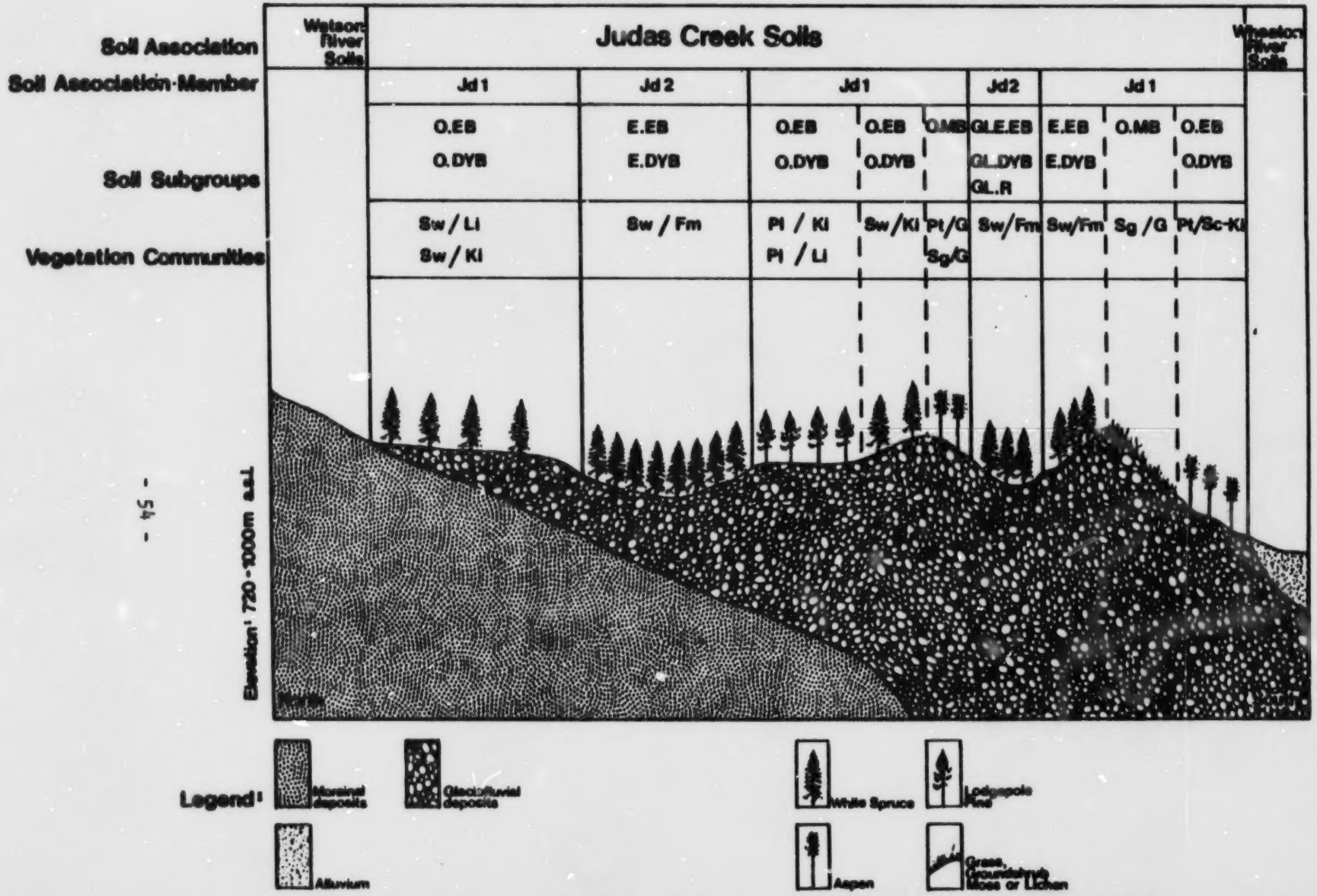


Figure 20 Texture of Glaciofluvial Material - Judas Creek Association

Fig.21
Schematic Profile of Judas Creek Association



5.2.9 Brooks Brook Association

Brooks Brook Complex Association consists of soils developed on glaciofluvial and morainal deposits which are so intermixed locally that they are impossible to separate at the mapping scale. Typically, the topography is an undulating or rolling plain which is criss-crossed with glaciofluvial deposits such as eskers and kames. Morainal deposits are found in the flat areas between hill crests and ridges. Other areas have till blankets which have been partially reworked by glaciofluvial meltwater. This complex of morainal and glaciofluvial deposits often occurs adjacent to other glaciofluvial deposits.

Slopes range from gentle to steep (2-30%), with local relief of 10-20 m. Glaciofluvial and morainal complexes are most often found between 720 m (2400') and 1200 m (4000') a.s.l. A layer of loess or wind-blown sand is sometimes found on the surface; however its distribution is not continuous. The texture of the parent material is variable ranging from loam to sand with 20-60% gravel and cobbles.

The major associates in the Brooks Brook Complex are Orthic Dystric Brunisol and Orthic Eutric Brunisol. These soils occupy moderately well to rapidly drained sites associated with White Spruce/Willow-Shrub Birch or White Spruce/Lichen communities. Table 9 (Appendix H) describes the profile and characteristics of a well drained Orthic Eutric Brunisol.

Common associates of Brooks Brook Complex include Eluviated Eutric Brunisol and Eluviated Dystric Brunisol which occur on moderately to imperfectly drained sites. The dominant vegetation communities found are White Spruce/Feathermoss and White Spruce/Willow-Shrub Birch. In depressions, drainage is imperfect to poor. There is great variability in the minor soil associates encountered, but Orthic Gleysol and Orthic Humic Gleysol predominate. The associated communities are White Spruce/Willow-Shrub Birch, White Spruce/Bog moss or Willow-Shrub Birch/Bog moss. Regosolic Static Cryosol soils may occur on some poorly drained lower slopes commonly associated with a Black Spruce/Sphagnum vegetation community.

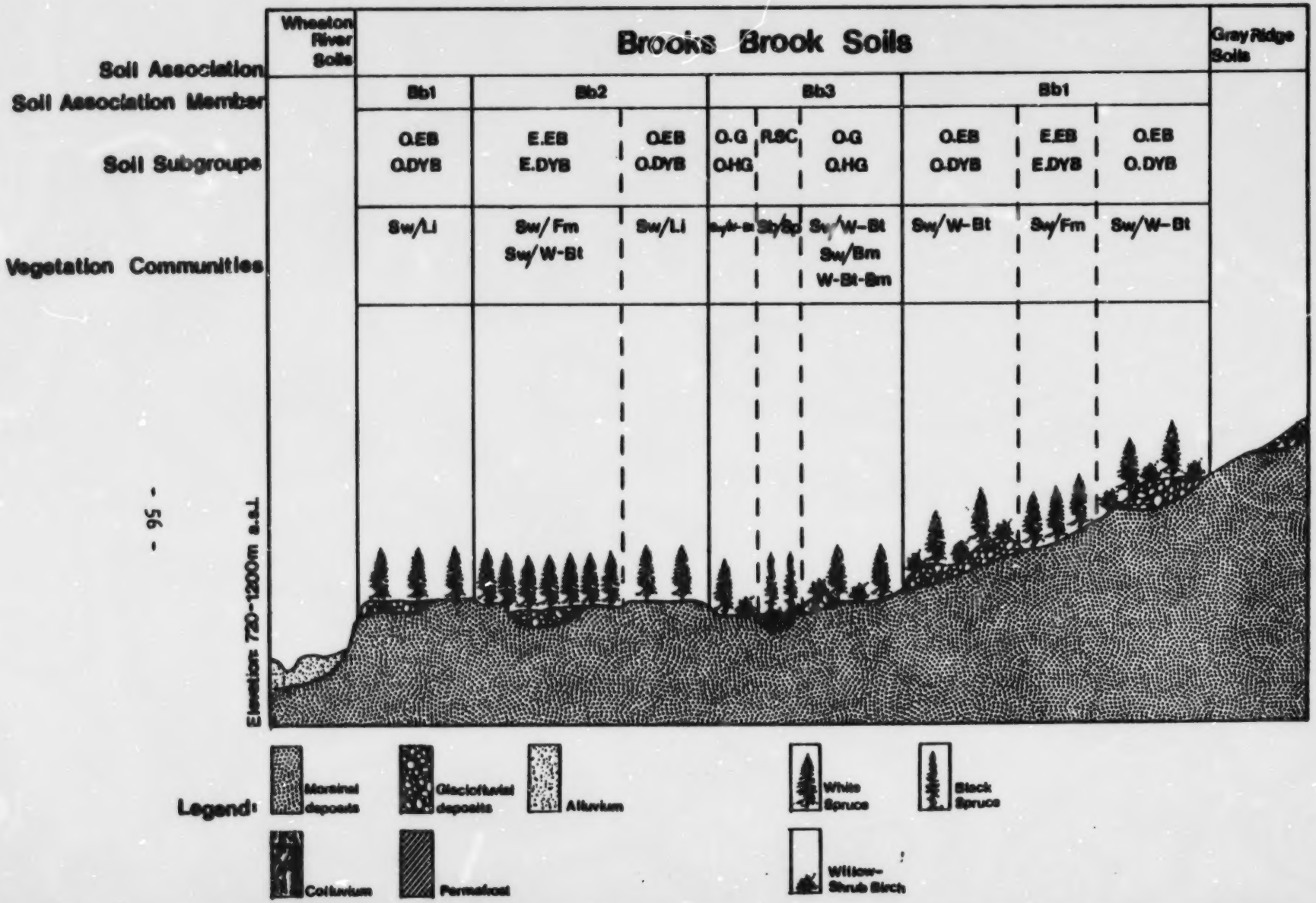
A schematic cross-section illustrating the distribution of Brooks Brook Complex soils and vegetation is presented in Figure 22.

5.2.10 Watson River Association

Watson River Association is comprised of soils developed on morainal deposits (till) which cover extensive portions of the study area. Morainal deposits are found as thick undulating or rolling plains in valley bottoms, or as blankets and veneers reflecting the underlying bedrock topography. They probably underlie most valley bottom deposits. Isolated drumlins and drumlin fields are found throughout the study area. Very often the drumlinoid features are bedrock cored covered by a thin morainal veneer. Till deposits may extend up steep (15-30%) mountain slopes to elevations as high as 1500 m (5000') a.s.l. and even higher in parts of the Coast Mountains. In these situations, morainal material is often colluviated and/or intermixed with colluvium derived from local bedrock sources.

Fig. 22

Schematic Profile of Brooks Brook Complex Association



All till deposits in the Southern Lakes area have essentially the same geological age (Hughes et al., 1969). However, the till material is quite heterogeneous in physical and chemical properties. Parent material texture ranges from clay loam to sand, with loam and sandy loam appearing to be the more common textures (Figure 23). Generally, morainal deposits in high elevations are coarser in texture than those on plains and in valleys. Typically, the parent material is friable to firm, moderately pervious, and contains 20 to 50% subrounded to subangular gravel, cobbles, and odd boulders. The parent material is usually non-calcareous. However, in some areas, weak to moderate calcareous till pockets are found. These higher carbonate till deposits are not directly related to the underlying bedrock and they underscore the heterogeneous nature of the parent material.

Till deposits in valley floors and plains are often covered by a thin mantle of loess or eolian sand 30-50 cm thick. The irregularly distributed wind-blown deposits are usually discontinuous. They seldom occur above 1200 m (4000') a.s.l. Whenever wind-blown materials do occur, the surface texture of the soil is a stone-free loamy sand.

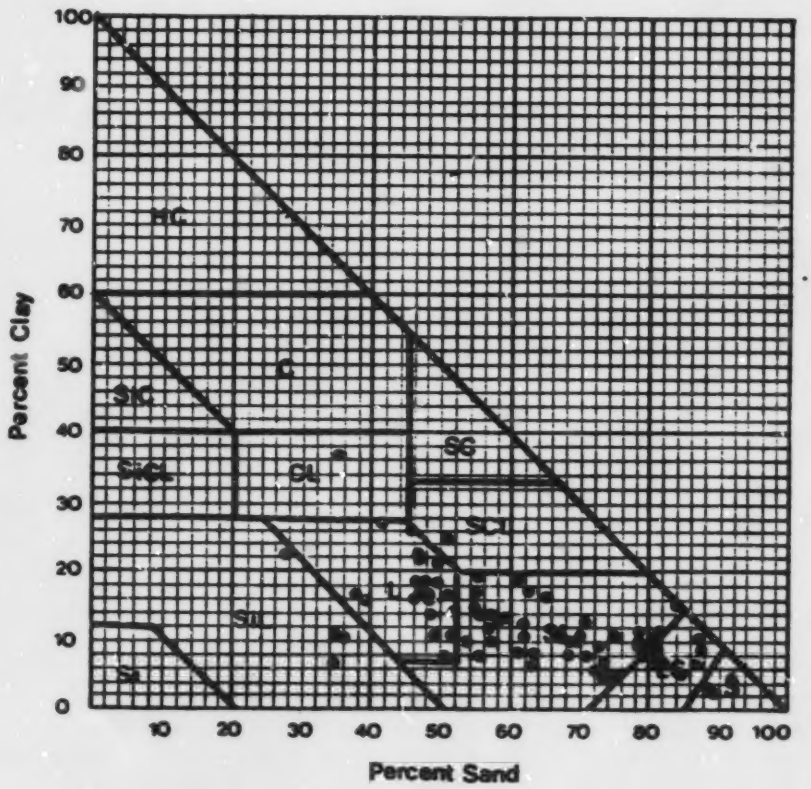


Figure 23 Texture of Morainal Material - Watson River Association

Dominant soils in the Watson River Association are Orthic Dystric and Orthic Eutric Brunisol (Plate 13). In pockets of calcareous parent material, only Orthic Eutric Brunisol soils are found. However, in other areas both Orthic Eutric and Orthic Dystric Brunisol soils are found on moderate to well-drained sites which are very similar in character. Typically, these soils associate with White Spruce/Lichen and White Spruce/Feathermoss communities. At higher elevations, Willow-Shrub Birch/Lichen, Willow-Shrub Birch/Dryas and White Spruce/Willow-Shrub Birch communities are found. Table 10 (Appendix H) presents the profile description and parent material characteristic of an Orthic Dystric Brunisol. The site is located on a well drained, level till plain.

Common associates of the Watson River Association include gleyed and/or eluviated members of Dystric and Eutric Brunisol soils. Eluviated Brunisol soils are found on moderate to imperfectly drained sites on midslopes of mountains and ridges. They usually associate with White Spruce/Feathermoss and White Spruce/Willow-Shrub Birch communities. Gleyed and Gleyed Eluviated Brunisol soils are imperfectly drained soils found on lower slopes. They most often occur under White Spruce/ Feathermoss and White Spruce/Bog moss communities (Plate 14).

Other common associates are Orthic Sombric and Orthic Melanic Brunisol soils. These are moderately well drained soils found at higher elevations on mountain slopes. They usually occupy level or gently sloping sites ocmmonly with southerly aspects. These soils have heavy organic matter accumulation in the A horizon, and are associated with graminoid communities. At the foot of mountain ranges the drainage condition is often imperfect to poor and seepage channels are sometimes found on the surface. In these areas, Orthic Humic Gleysol is the most common soil usually associated with White Spruce/Willow-Shrub Birch, White Spruce/Bog moss or Willow-Shrub Birch/Bog moss communities.

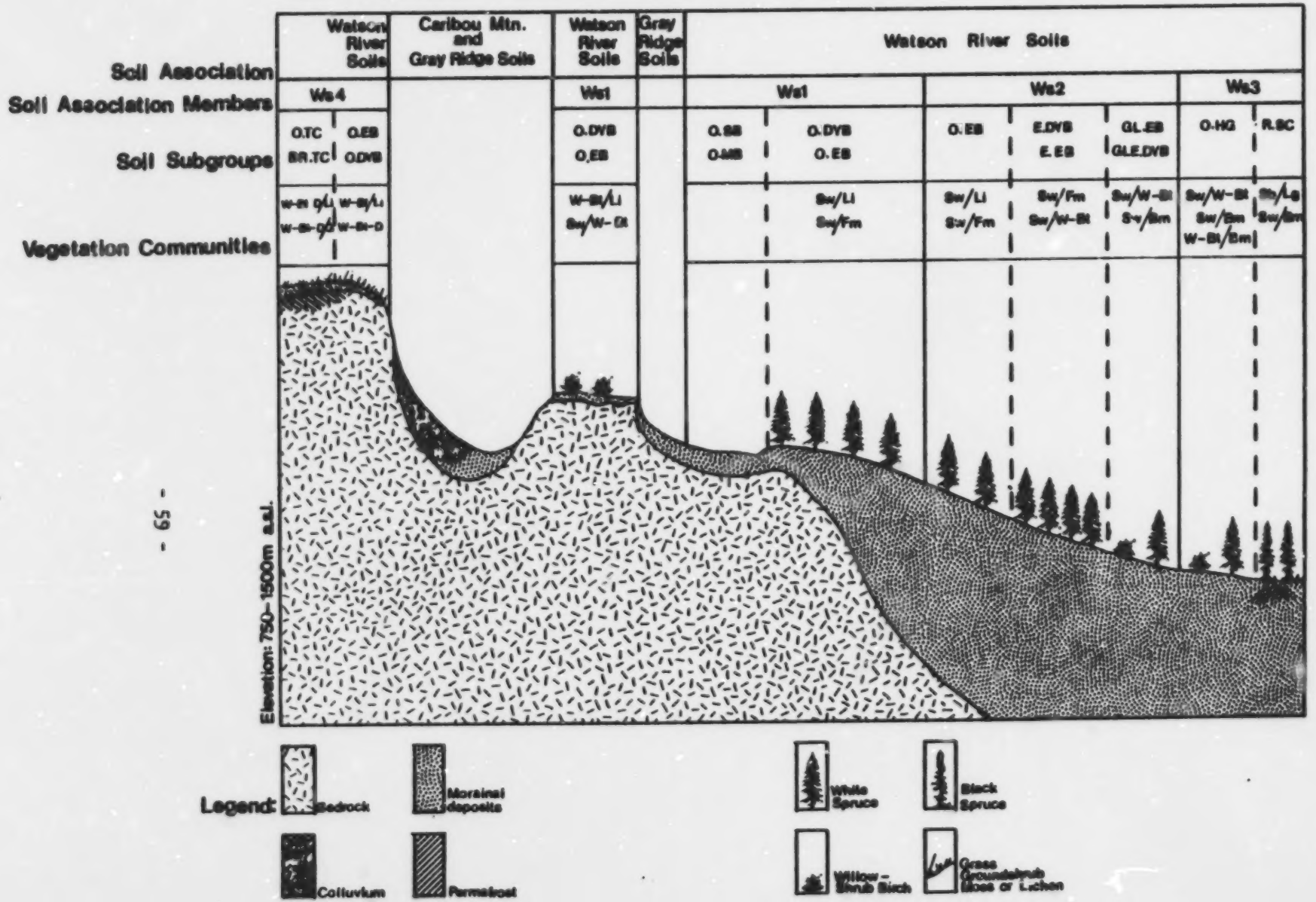
Till occurs on some mountain peaks above 1500 m (5000') a.s.l. Permafrost may be associated with well-developed patterned ground found in these areas. Soils are usually well drained and they are commonly Orthic Turbic Cryosol though Brunisolic Turbic Cryosol is also found. Common alpine communities found on these soils are Willow-Shrub Birch-Dryas/Lichen and Willow-Shrub Birch-Dryas/Grass. Regosolic and Orthic Static Cryosol soils may be found in poor to imperfectly drained areas in the foothills. However, these are minor associates within the Watson River Association. The occurrence of permafrost in till deposits is sporadic within the study area.

Figure 24 presents a schematic cross-section illustrating the distribution of Watson River soils and vegetation communities.

5.2.11 Tally-Ho Mountain Association

Tally-Ho Mountain Association is comprised of soils developed on neoglacial morainal material deposited by recent alpine glaciers. These soils are not extensive, and are restricted to recent mountain cirques and valleys above 1350 m (4500') a.s.l., which are present only in the Coast Mountains and the Big Salmon and Englishmen ranges. In the Primrose Lake area (map 105D-SW), these deposits are found in the vicinity of existing mountain glaciers.

Fig. 24
Schematic Profile of Watson River Association



The topography is generally rolling to hummocky, with local relief of 5 to 20 m, and slopes ranging from 10 to 30%. Landforms such as end moraines, recessional moraines, and hummocky ground moraine are all found (Plate 15). Tarns are common on the cirque floor.

The parent material is dominantly sandy loam to sand, with commonly 40 to 60% angular to subangular gravel, cobbles and boulder-size rubble. However, up to 90% coarse fragments may be found.

Orthic Regosol is a dominant associate commonly found on cirque floors. The parent material associated with Orthic Regosol is quite angular, rubbly, may contain little or no matrix, and is generally devoid of vegetation.

Regosolic Turbic Cryosol is an additional dominant associate which may be found in and below cirque basins. Cryoturbated blockfields, sorted circles and stripes, and nivation hollows are common features associated with this soil in moderately well to well-drained areas. The dominant vegetation communities on these soils are alpine Willow-Shrub Birch-Dryas/Grass and Willow-Dryas/Sedge-Grass.

Orthic Dystric Brunisols, and occasionally Orthic Eutric Brunisols, develop on older neoglacial material. These soils are well to moderately well-drained, and are generally under alpine or subalpine vegetation. Orthic Turbic Cryosol soils are also present.

A schematic cross-section illustrating the distribution of Tally-Ho Mountain soils and vegetation is presented in Figure 25.

5.2.12 Caribou Mountain Association

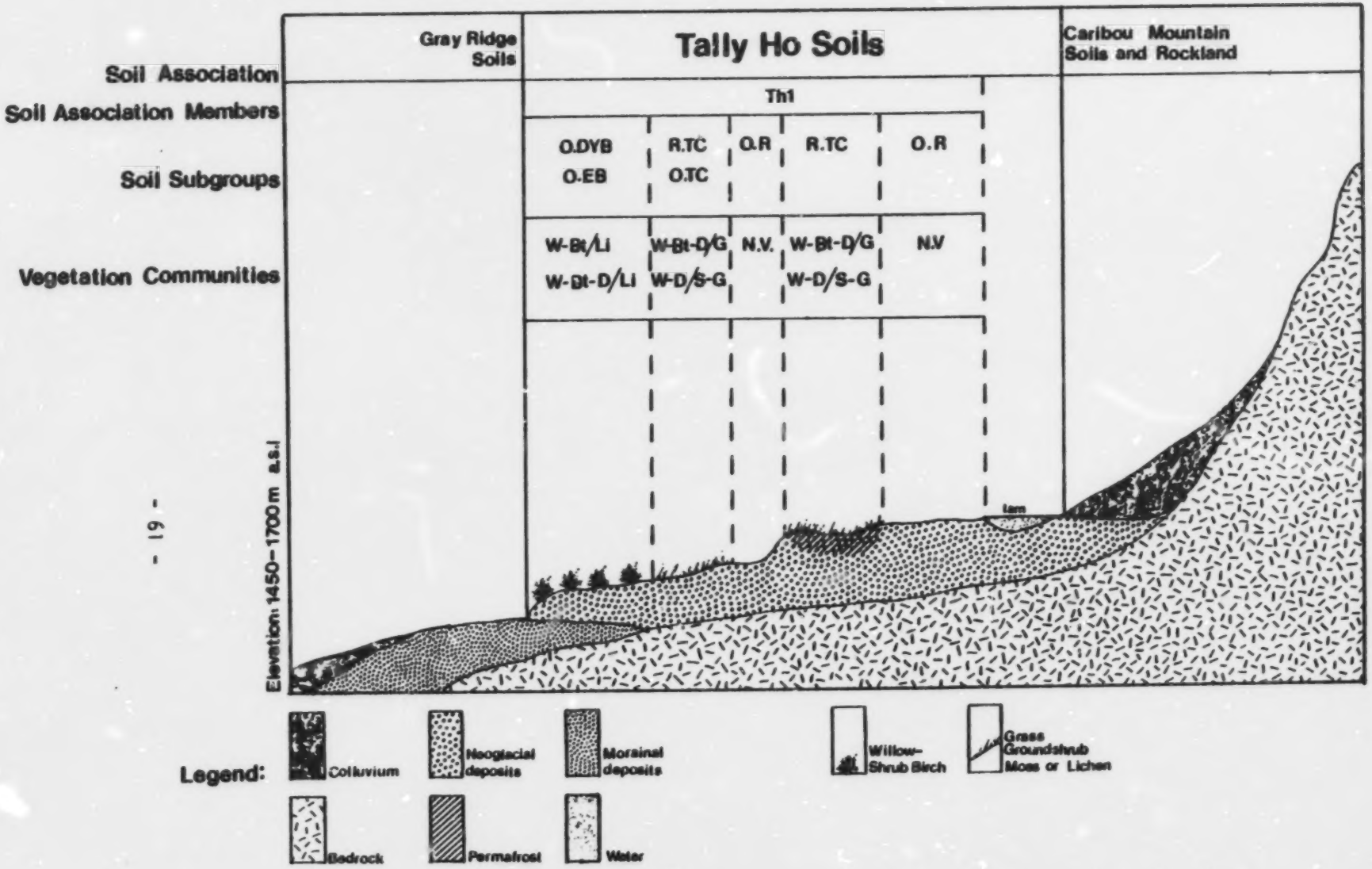
Caribou Mountain Association is comprised of soils developed on colluvial deposits. Fans and aprons at the base of steep rock faces and thin veneers over bedrock at elevations greater than 1500 m (5000') a.s.l. are the common colluvial landforms found. These are most extensive in the Coast Mountains but are found throughout the study area. Often colluvial material is mixed with morainal material as in the Gray Ridge Complex Association. Colluvial deposits usually occur on moderate to steep slopes (10-40%).

The parent material has a textural range from loam to sand, with sandy loam appearing to be the more dominant texture (Figure 26). It usually contains between 30 and 60% angular to subangular gravel, cobbles, and boulders but may contain up to about 99% coarse fragments. Typically, the material is friable to loose and rapidly to moderately pervious. Due to variations in local lithology, the parent material has a wide range of chemical characteristics. However, the parent material is usually non-calcareous to weakly calcareous.

Major members of Caribou Mountain Association are Orthic Eutric Brunisol and Orthic Dystric Brunisol soils. These moderate to well-drained soils are typically associated with Dryas/Grass/Lichen or Willow-Shrub Birch-Dryas/Lichen communities in alpine areas, Willow-Shrub Birch-Dryas/Lichen or Willow-Shrub Birch/Lichen communities in the subalpine (Plate 16) and White Spruce/Willow-Shrub Birch at lower elevations. Table 12 (Appendix H) presents a profile description and

Fig.25

Schematic Profile of Tally Ho Mountain Association



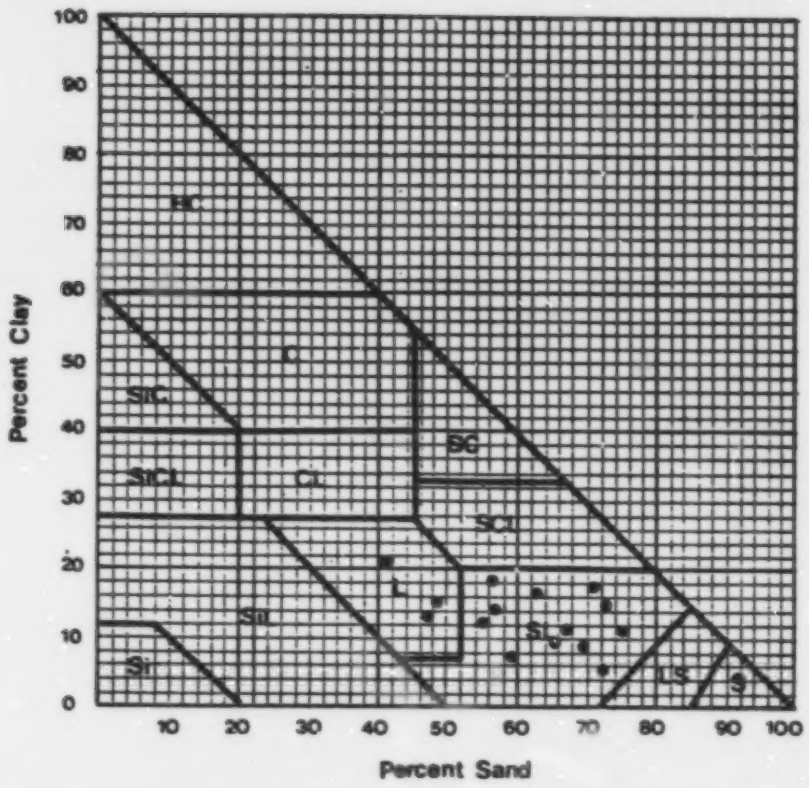


Figure 26 Texture of Colluvial Material - Caribou Mountain Association

characteristics of a moderately well drained Orthic Dystric Brunisol under alpine vegetation at an elevation of 1700 m (5670') a.s.l.

Common members of Caribou Mountain Association include Orthic Regosol, Eluviated Eutric Brunisol, Eluviated Dystric Brunsisol, Orthic Melanic Brunisol and Orthic Turbic Cryosol. Orthic Regosol is found on and at the base of steep mountain slopes where active frost shattering and colluviation of local bedrock produces fans, aprons, veneers, and scree slopes (Plate 17). The parent material is angular, rubbly, and usually non-vegetated. Eluviated Eutric Brunisol and Eluviated Dystric Brunisol soils occur on moderate to well drained sites associated with boreal White Spruce/Willow-Shrub Birch communities. These soils have a well-defined sandy Ae horizon. Orthic Melanic Brunisol soils have a well developed Ah horizon; these soils are found in imperfectly to moderately well drained sites at the foot of solifluction lobes and on south-facing slopes. They commonly associate with Willow-Shrub Birch-Dryas/Grass or Sedge-Grass/ Lichen communities. Orthic Turbic Cryosol is found in permafrost terrain at elevations above 1700 m (5670') a.s.l. These soils are usually moderately well drained and they associate with well developed patterned ground and Dryas/Grass/Lichen and Willow-Shrub Birch-Dryas/Lichen vegetation communities.

Figure 27 presents a schematic cross-section illustrating the distribution of Caribou Mountain soils and associated vegetation communities.

5.2.13 Gray Ridge Complex Association

Gray Ridge Complex Association is composed of soils developed on a mixture of morainal and colluvial deposits. On actively wasting mountain slopes, clear distinction between till and colluvium becomes impossible. Thus the parent material and landform characteristics of Gray Ridge Complex Association share common traits with those of Watson River Association and Caribou Mountain Association. Morainal/colluvial deposits can be found at elevations ranging from 1000 m (3300') to greater than 1800 m (6000') a.s.l. Covering many slopes, the Gray Ridge Complex is probably the most commonly mapped association in the study area. The topography is usually moderately to steeply sloping, between 10 and 40%, and the long mountain slopes are often interrupted by benches, depressions and scarps. Wind-blown materials are usually absent in the soil, however a thin layer of ash frequently occurs. Parent material textures of loam and sandy loam are common usually containing between 20 and 60% gravel and cobbles.

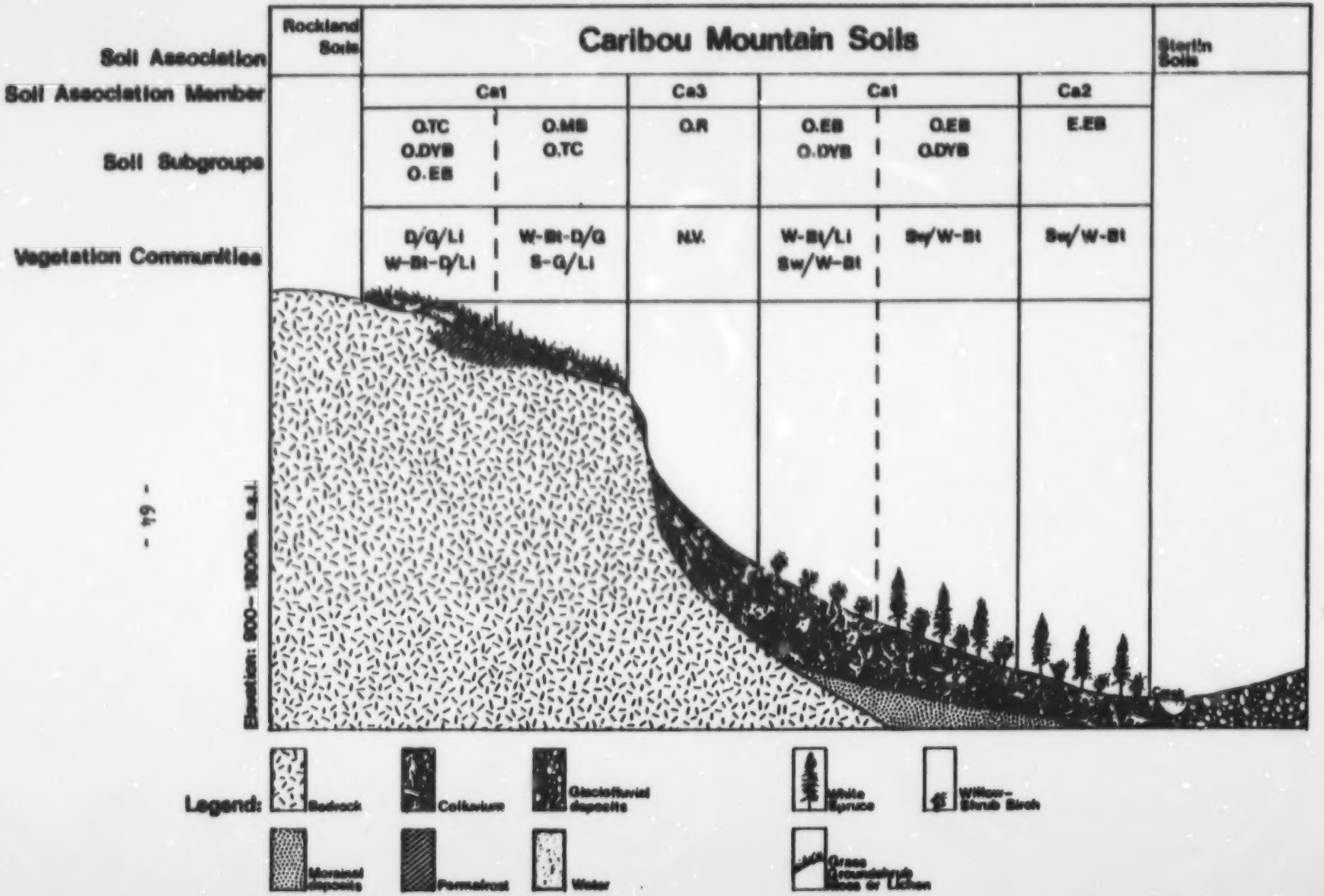
The major members of Gray Ridge Complex Association are Orthic Eutric Brunisol and Orthic Dystric Brunisol. In terms of distribution, these soils follow the pattern outlined for members of the Caribou Mountain and Watson River Soil Associations. Orthic Eutric and Dystric Brunisol soils are found on well drained upper slopes associated with White Spruce/Willow-Shrub Birch (Plate 18), Alpine Fir/Willow-Shrub Birch and Willow-Shrub Birch communities. Table 13 (Appendix H) presents the profile description and parent material characteristics of an Orthic Dystric Brunisol on a moderately well-drained 26% north slope. The elevation is about 1300 m a.s.l. and the dominant community is Alpine Fir/Willow-Shrub Birch.

Significant members include Gleyed and/or Eluviated Eutric and Dystric Brunisol, Orthic Humic Gleysol and Orthic Turbic Cryosol. Eluviated Eutric and Dystric Brunisol soils are found on moderately well to imperfectly drained slopes under a White Spruce/Willow-Shrub Birch communite (Plate 19). Imperfectly drained Gleyed Eutric and Dystric Brunisol, and Gleyed Eluviated Eutric and Dystric Brunisol soils are usually found at the base of slopes in depressions associated with White Spruce/Willow-Shrub Birch or White Spruce/Feathermoss communities. Orthic Humic Gleysol soils are also found at the base of slopes. These poorly drained soils are associated with Willow-Shrub Birch/Bog moss or White Spruce/Willow-Shrub Birch vegetation communities. Orthic Turbic Cryosol soils occur on moderately well-drained sites approaching 1700 m a.s.l. These soils usually associate with patterned ground, and alpine tundra vegetation (Plate 20).

Orthic Sombric Brunisol, a minor associate is found on moderately well to imperfectly drained subalpine sites. It is often associated with a Willow-Shrub Birch/Grass-Sedge community. Near the lower portion of solifluction slopes it is often associated with a Willow-Shrub Birch/Grass-Sedge community. On south aspects, graminoid communities are common. An additional minor soil associate is Regosolic Static Cryosol occasionally found on poorly drained lower slopes associated with a Black Spruce/Ledum community.

Fig. 27

Schematic Profile of Caribou Mountain Association



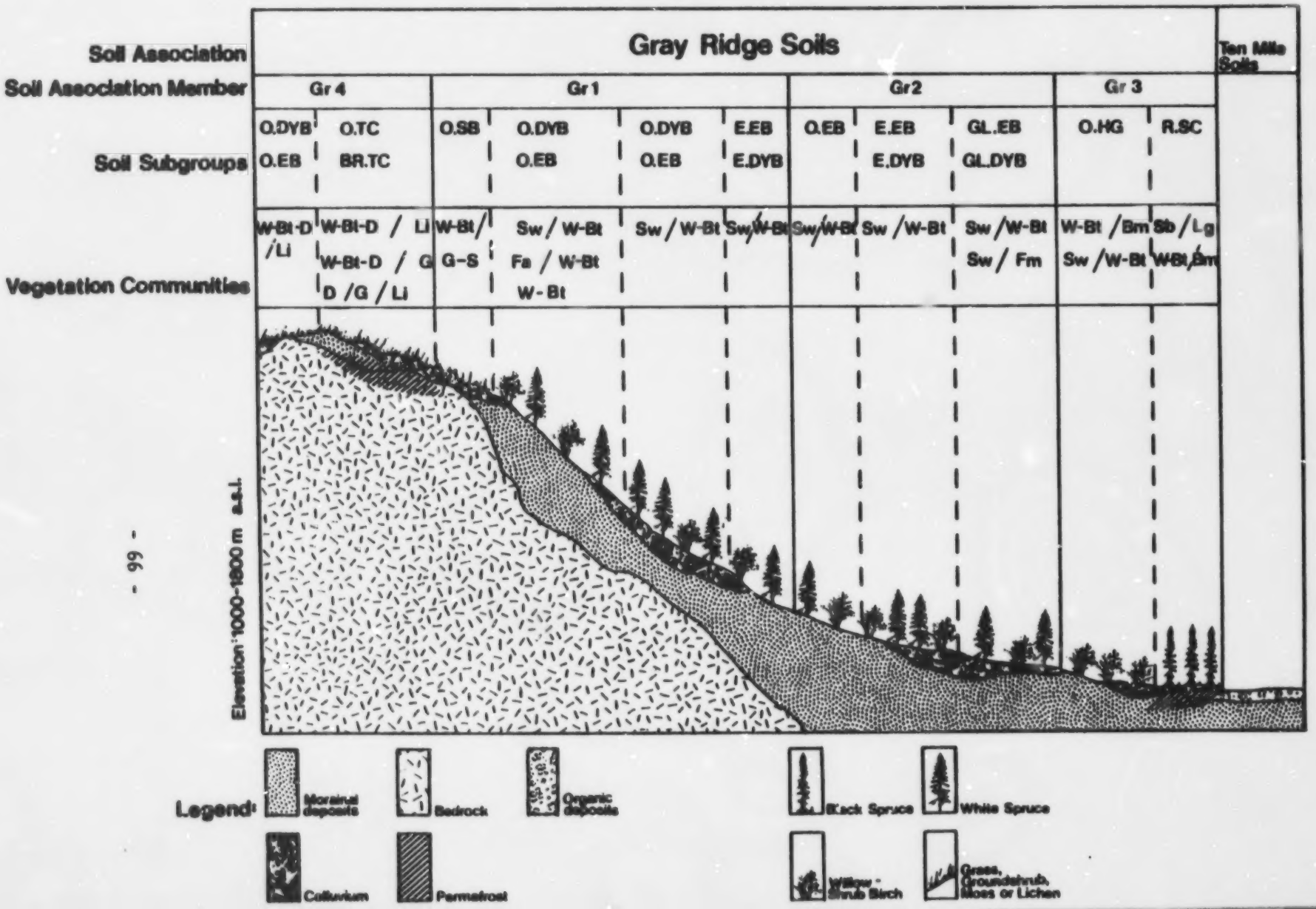
A schematic cross-section illustrating the general distribution of Gray Ridge soils and vegetation communities is presented in Figure 28.

5.2.14 Rockland Association

Rockland is commonly used to describe those areas of extensive exposed bedrock (Plate 21). These bedrock areas may occur at elevations ranging from 700 m to 2400 m (2700-6000') a.s.l., but they are most common on mountain peaks above 1700 m (2700-6000') a.s.l. Rockland often occurs in conjunction with morainal and/or colluvial deposits. In bedrock areas, unconsolidated material becomes discontinuous and where present, it may be less than 10 cm thick. Scattered pockets often contain deeper surficial deposits.

At high elevations, these areas are barren except for patches of rock lichens; but in low elevations lodgepole pine and white spruce may grow in fractures of the bedrock.

Fig. 28
Schematic Profile of Gray Ridge Complex Association



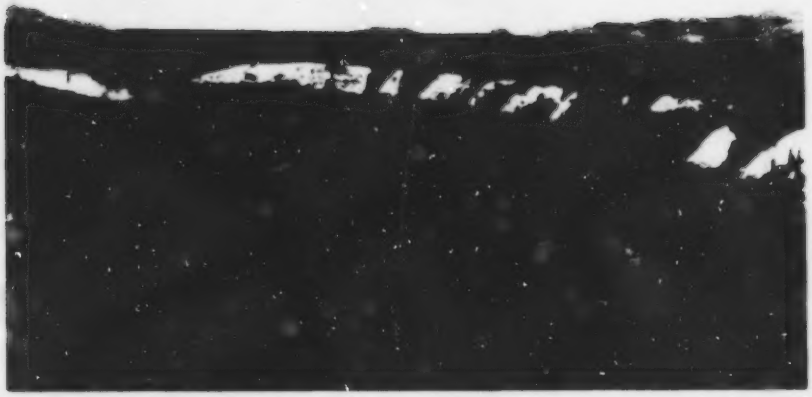


Plate 1 Champagne 1 (Ch1)

An extensive lacustrine plain occupying a wide valley floor, is dissected by the Teslin River. Champagne 1 soils are typical of these well drained lacustrine plains.

Plate 2 Champagne 2 (Ch2)

A shrubland dominates this level lacustrine plain typical of Champagne 2 soils.

Plate 3 Champagne 4 (Ch4)

Thermokarst terrain associated with Champagne 4 soils. This area is characterized by numerous small ponds with collapsing banks resulting from the melting of ground ice.

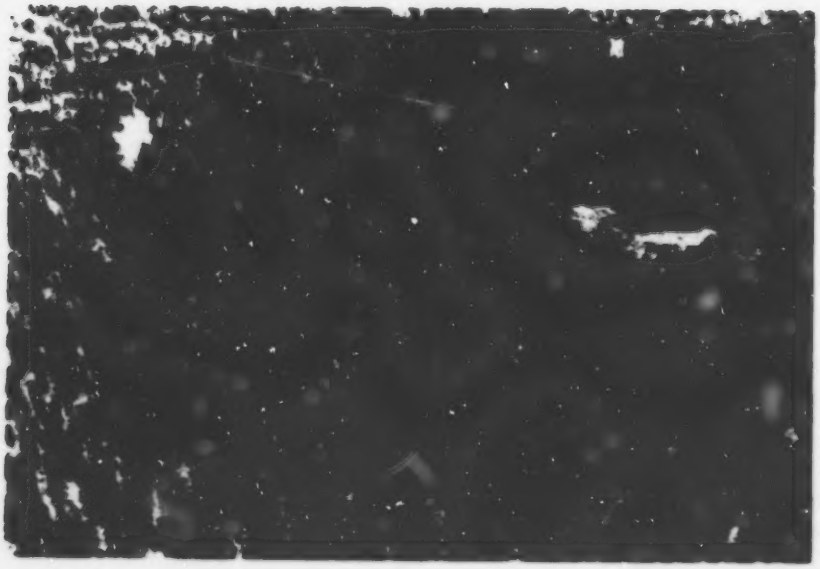


Plate 4 Morley Bay 1, 2 and 3 (Mb1,2,3)

Morley Bay 1, 2 and 3 soils are associated with the variable undulating terrain in this photograph.

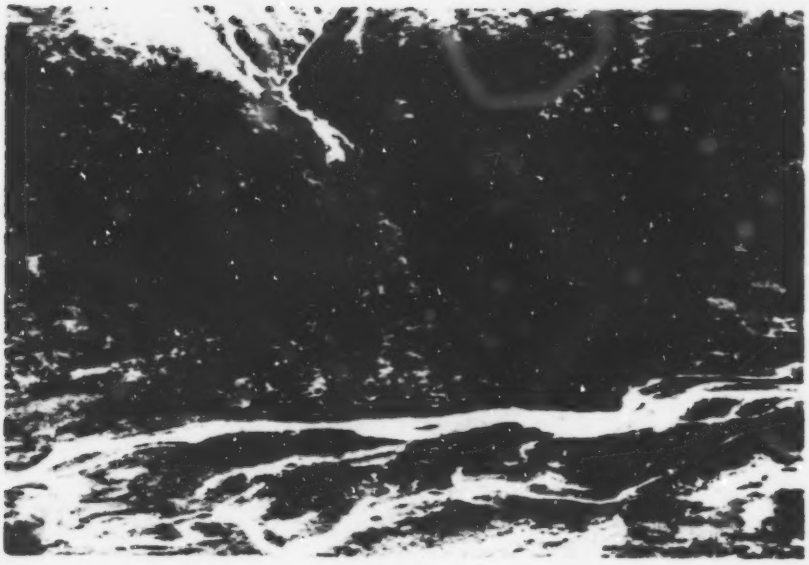


Plate 5 Sterlin 1 (St1)
Alluvial fan dominated by Sterlin 1 soils.

Plate 6 Wheaton River 1 (Wt1)
Willow/Sedge community dominates the Wheaton River 1 soils found on this alluvial delta.

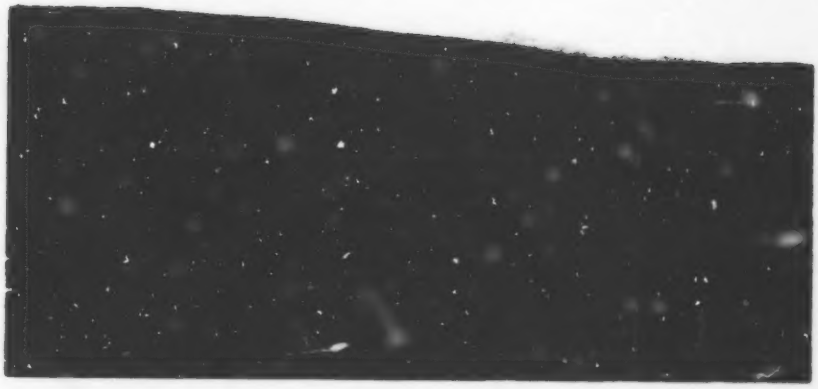


Plate 7 Wheaton River 2 (Wt2)

Shrubby alluvial plain associated with Wheaton River 2 soils.

Plate 8 Nisutlin 1 and 2 (Ns1,2)

Alluvial plains, terraces and wetlands of the Nisutlin River are characterized by a complex of mineral and organic soils of the Nisutlin Complex Association.

Plate 9 Ten Mile 1 (Tn1)

Small mid elevation valley associated with Ten Mile Creek 1 soils.

Plate 10 Ten Mile 2 (Tn2)

Poorly drained lower slope with characteristic shrubby vegetation and Ten Mile Creek 2 soils.

Plate 11 Carcross 1 and 2 (Cs1,2)

Carcross 1 and 2 soils are found on these sand dunes at the north end of L. Bennett.

Plate 12 Judas Creek 1 (Jd1)

Hummocky and ridged terrain formed beneath stagnant glacier ice is associated with Judas Creek 1 soils.

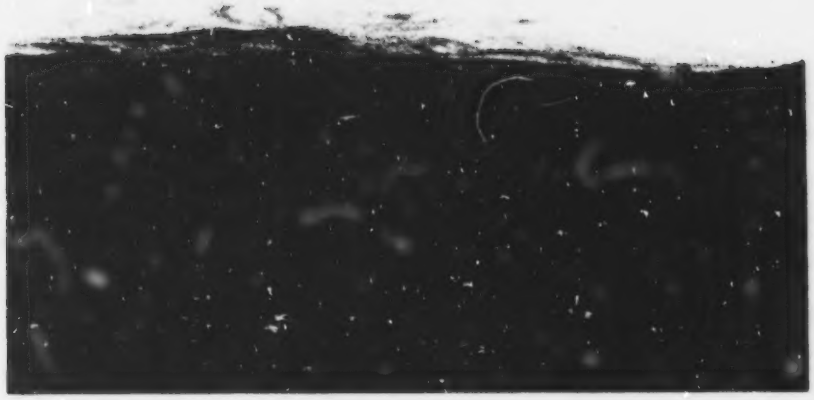


Plate 13 Watson River 1 (Ws1)

White Spruce/Lichen forest typical of well drained morainal blankets is associated with Watson River 1 soils.

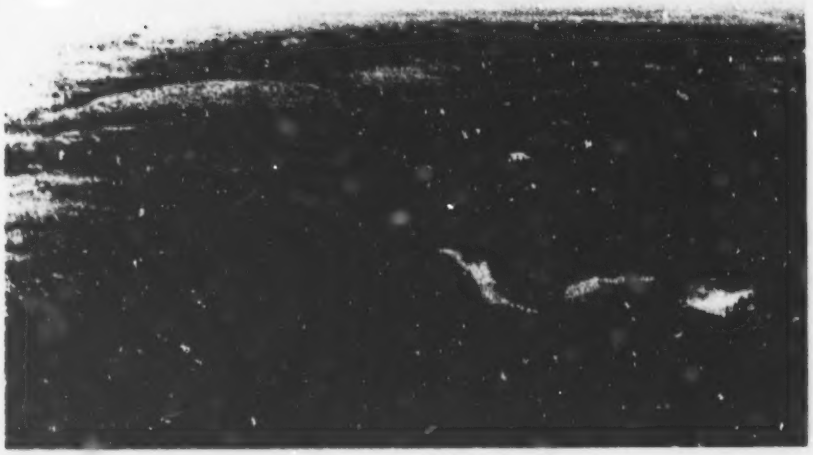


Plate 14 Watson River 2 (Ws2)

Watson River 2 soils dominate this channelled morainal blanket deposit.

Plate 15 Tally Ho Mountain 1 (Tn1)

Old cirque valley characterized by Tally Ho Mountain soils.

Plate 16 Caribou Mountain (Ca1)

Caribou Mountain 1 soils are typical of steep colluvial slopes.

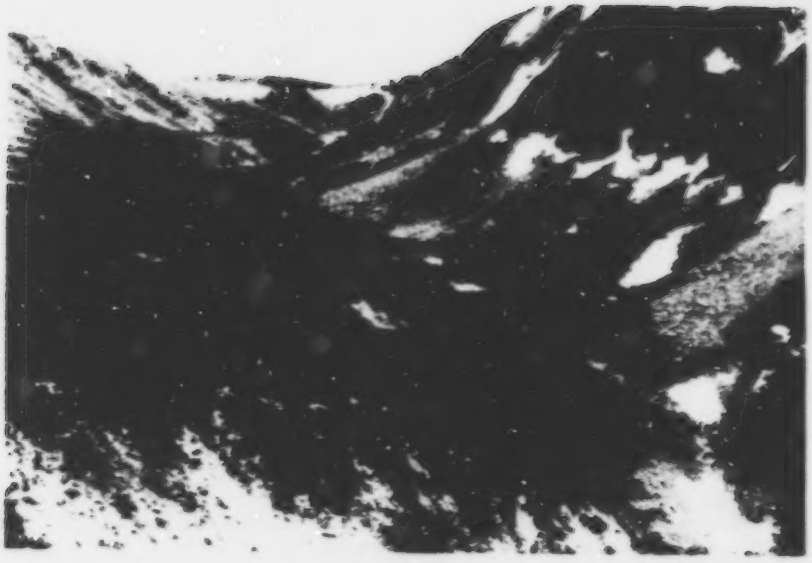


Plate 17 Caribou Mountain 3 (Ca3)

Non vegetated colluvial aprons are characterized by Ca3 soils.

Plate 18 Gray Ridge 1 (Gr1)

Gray Ridge 1 soils are usually found on moderately steep slopes.

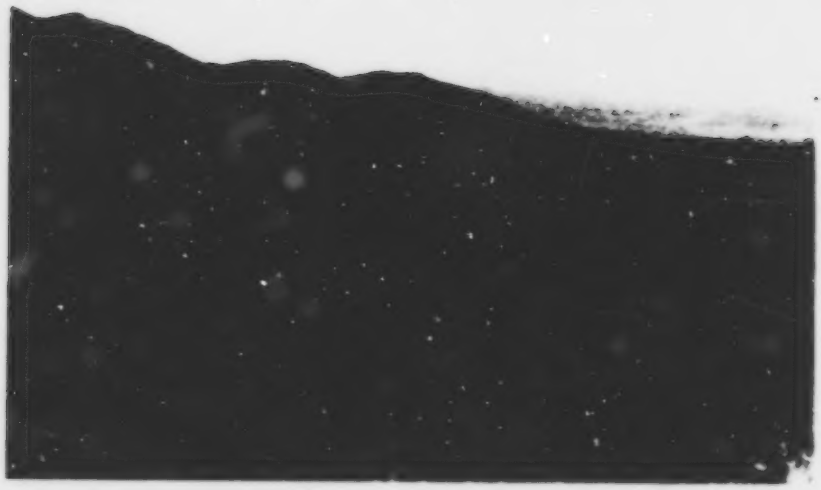


Plate 19 Gray Ridge 2 (Gr2)

Moderate lower slopes are often associated with Gray Ridge 2 soils.

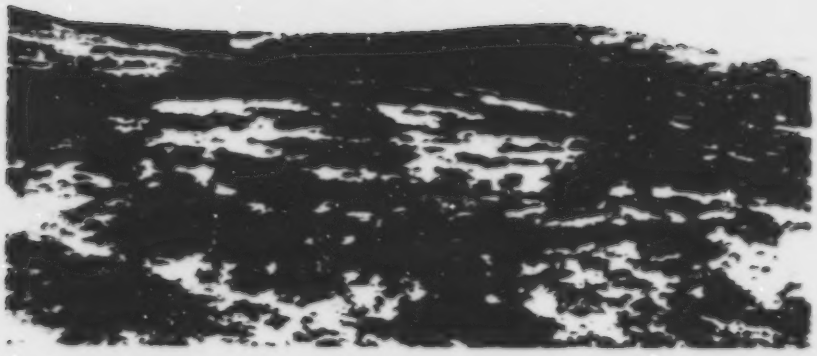


Plate 20 Gray Ridge 4 (Gr4)

Patterned ground, on exposed alpine ridges and plateaus, is often associated with Willow-Shrub Birch/ Dryas/Grass communities and Gray Ridge 4 soils.

Plate 21 Rockland (R)

Mountain slope dominated by exposed bedrock.

5.3 Important Geomorphologic Features and Processes

Numerous geomorphologic features and processes present in the Southern Lakes area have been observed. The following are of special interest: thermokarst, wind erosion, debris flows, gullying, solifluction, nivation, cryoturbation, rock glaciers, palsas and string fens.

Thermokarst topography (Plate 3) occurs where there has been extensive melting of ground ice resulting in local subsidence and collapse of the ground surface. The depressions formed usually fill with water. Thermokarst is usually found in valley bottoms filled with alluvial and lacustrine sediments. These silty materials, when supplied with plentiful water, favour the development of ground ice. Changes in vegetative cover, water availability, climatic regime and other processes may cause thermokarst development. Thermokarst is associated with soil association member Champagne 4. It has been identified in numerous locations in the Southern Lakes often adjacent to large lakes or along rivers. West of Marsh Lake, the Takhini River Valley and north of Little Atlin Lake are some extensive thermokarst areas.

Wind erosion and deposition were probably very extensive during immediate post glacial times. Even now they are important processes in lowland areas (Plate 22). Sand dunes presently stabilized by vegetation are found in several localities such as south of Lake Laberge. Soils developed on these eolian deposits belong to the Carcross Association. Occasionally, one finds active dunes where old dunes have been disturbed, as at the northeast end of Lake Bennett.

Several slope failures in the form of debris flows (Plate 23) were noted in the central and eastern portions of the study area. They are found, typically on moderate slopes covered by fairly thick glacial deposits, and appear to originate along a seepage depression. These debris flows can be attributed to local conditions of soil moisture saturation resulting in high pore water pressure which may exceed the shear strength of the material. This form of rapid mass movement probably occurs in rubbly and gravelly sediments with a fine matrix which has high liquid limits. This process was described by French (1976) with respect to mud flows. In the study area, debris flows are usually associated with Gray Ridge, Watson River or Morley Bay soils. An example of a debris flow can be seen north of Deadmans Creek, north of Teslin Lake. Slumps and mudflows in lacustrine deposits (Plate 24) are also common features within the study area.

Gullies, incised into fine sediments along the banks of rivers occur. Numerous gullies associated with Champagne soils are found along the banks of the Yukon and Takhini Rivers. Throughout the Coast Mountains extensive gullying of steep bedrock slopes is common (Plate 25).

In higher alpine areas, solifluction, the slow downslope movement of water saturated soil over a solid or frozen base, occurs. Solifluction lobes are usually found on moderate to steep slopes with tundra vegetation (Plate 26). Associated with Gray Ridge 4 soils, solifluction is common on upland slopes in the Coast Mountains.

Also in alpine areas, typically on northfacing slopes, one finds nivation hollows (Plate 27). Long persisting spring and summer snow patches cause erosion

of underlying material resulting in unvegetated hollows extending across the slope. Nivation hollows are usually found associated with Gray Ridge 4 and Watson River 4 soils. They are most extensive in the Coast Mountains but are also present in the Big Salmon Range.

On most exposed ridges of tundra vegetation cryoturbation, the movement of soil particles by frost action, is prevalent. In response to frequent freezing and thawing of the ground and resultant development of ground ice and changes in the volume of the surficial material, ground patterns such as circles, nets, stripes and steps, outlined by vegetation, develop (Plate 28). Sorting of the material may occur within these patterns, due to differential movement of variously sized particles resulting from frost action. Cryoturbation is common on Rockland, Gray Ridge 4 and Watson River 4 soils.

Blockfields, also known as felsenmeer, are found above treeline in mountainous areas associated with bedrock and Gray Ridge 4 soils. Blockfields are accumulations of rock rubble, fragmented by frost from the subjacent bedrock (Plate 29). The size and angularity of the rocks is dependent on the bedrock type.

Some rock glaciers up to 350 m across and one kilometre long are found along the sides of several valleys in the Coast Mountains (Plate 30). These features appear to originate in small cirque valleys where there is abundant colluvial debris and where the ice-cored rock debris can migrate downslope in the form of a small glacier. Movement is indicated by corrugations of the surface. Several rock glaciers are visible along the upper Wheaton River Valley.

Palsas are ice-cored mounds, usually 5-10 m across rising approximately 2 m above the surrounding wetland. Associated with the Tenmile Creek soil association, they are found in numerous wetlands throughout the Southern Lakes area. Peat cored palsas may be found in depressions at higher elevations (Plate 31). Mineral cored palsas occur in some low to mid elevation wetlands. West of Teslin Lake, palsas are found in some old meltwater channels.

String fens (Plate 32) have developed in some wetlands, associated with Tenmile Creek 2 soils. They consist of a series of raised bands or strings of vegetation usually separated by water. Orientation is approximately perpendicular to water movement. A string fen can be seen west of Hassel Lake in the southeast corner of the study area.

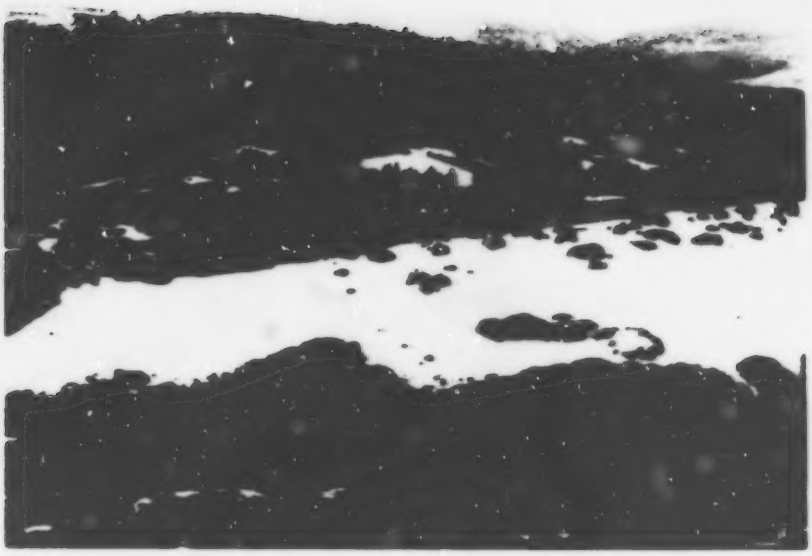


Plate 22 Sand dunes

Active deflation on these sand dunes prevents the establishment of vegetation.

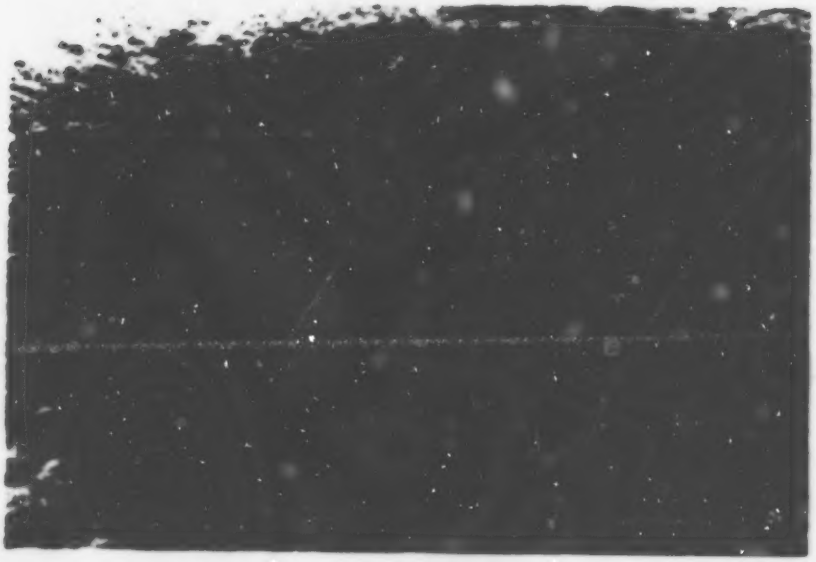


Plate 23 Debris flow

This debris flow originated in a gully on a morainal slope. Downslope flow appears to have occurred several times.

Plate 24 Slump

Slumping is common along rivers incised into fine grained lacustrine deposits.

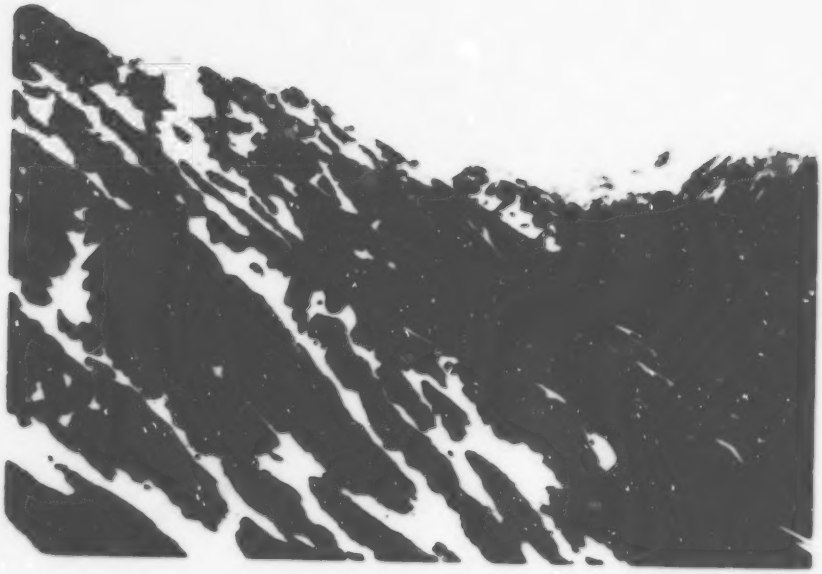


Plate 25 Gullying

Residual snow patches accent gullies on this steep rock slope.

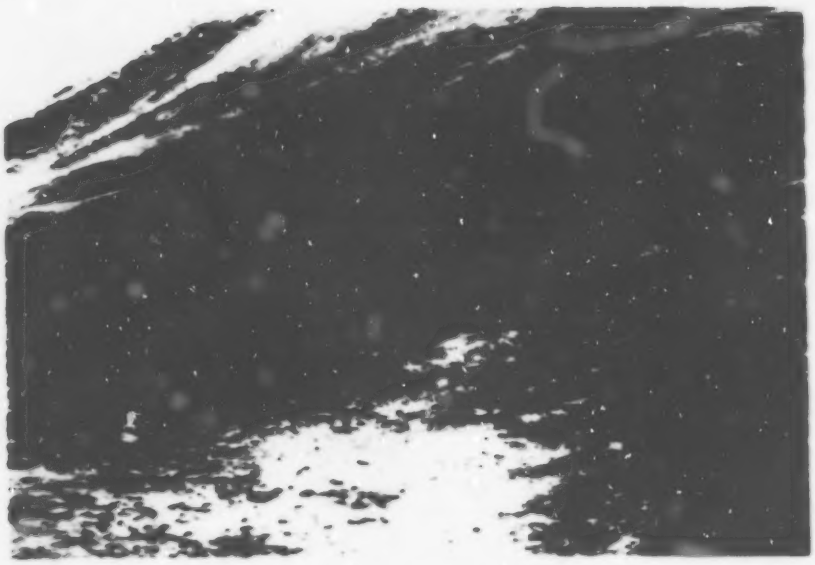


Plate 26 Solifluction

Solifluction lobes moving slowly downslope are typical of many alpine slopes.

Plate 27 Nivation hollows

Erosion associated with residual snow patches has developed nivation hollows on this alpine slope.

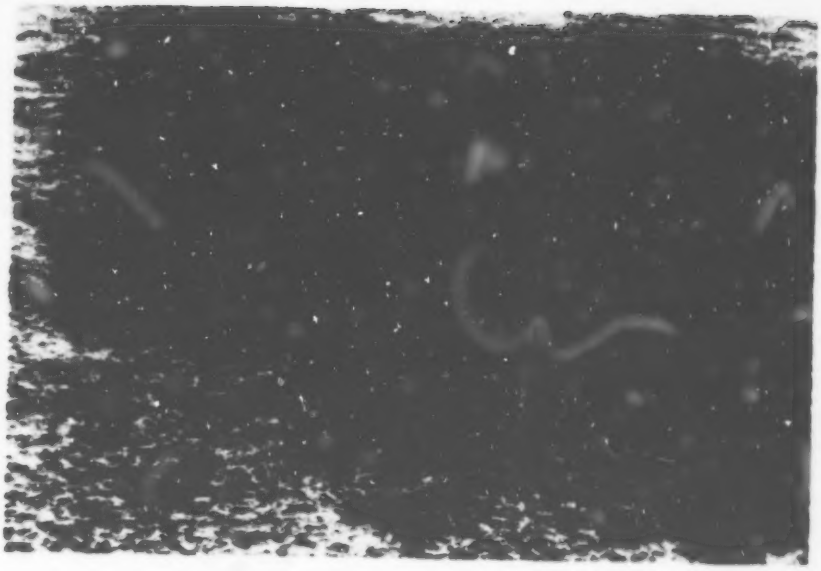


Plate 28 Patterned ground

These circles are a result of cryoturbation - the movement of soil particules by frost action.

Plate 29 Felsenmeer

This felsenmeer was formed by frost shattering of the underlying bedrock.

Plate 30 Rock glacier

The corrugations on the surface of this rock glacier are indicators of its slow downslope movement.

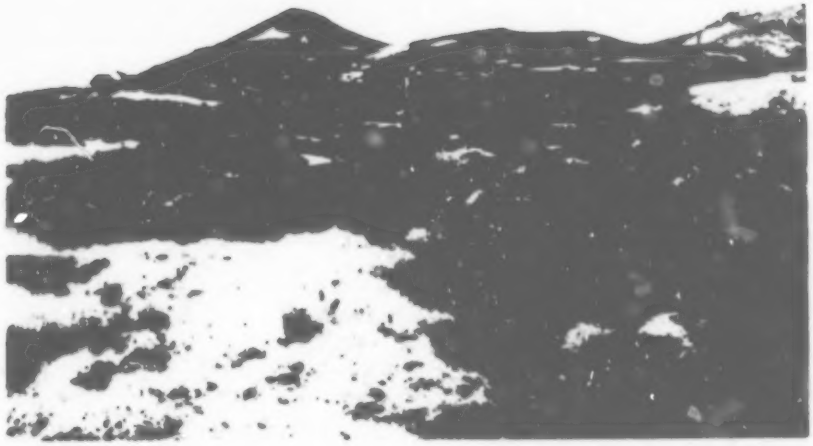


Plate 31 Palsa

This peat and ice cored mound is raised above the surface of the surrounding wetland.

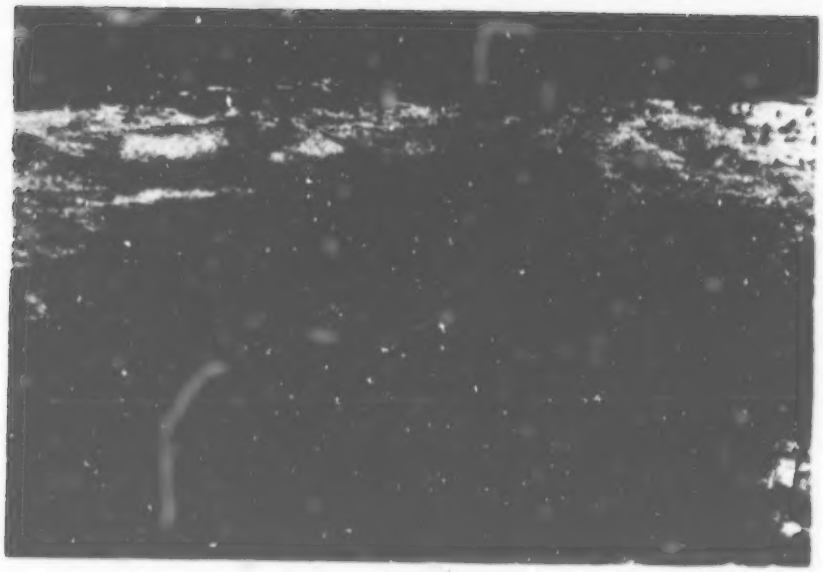


Plate 32 String Fen

Raised bands of vegetation separated by water characterize this wetland form.

6. VEGETATION[9]

6.1 Methodology - Sampling and Mapping

6.1.1 Field Sampling

In preparation for the summer field program, a review was made of pertinent literature on vegetation classification (Viereck and Dyrness, 1980; Rowe, 1968). A tentative classification scheme was derived, dividing the vegetation into six major classes (Tundra, Forest, Woodland, Shrubland, Herbaceous and Ground Shrub, Wetlands) and 29 subclasses, according to species composition, height and density.

Representative vegetation sampling sites were selected from a range of terrain and soil types, identified from air photos (black and white, 1:50,000-1:70,000 scale, Appendix G) which had been pre-typed by the surficial geologist.

In the field, two base camps were established from which sampling sites were accessed via road or helicopter. Sampling was conducted on sites that were as homogeneous as possible, taking into account species composition as well as physical factors such as slope, aspect and drainage.

Sites were circular and measured approximately 20 metres in diameter. Vegetation sampling was frequently carried out in conjunction with soil sampling, in which case the soil pit was included within the perimeter of the vegetation sampling site.

A data card (Figure 29 and 30) was completed and photographs were taken at each of 214 sites. The dominant vegetation and physiognomic class were recorded; a visual estimate was made of the percent cover of each species and of non-vegetated areas. Trees and shrubs were listed separately by height class. In forested communities, the height, DBH (diameter at breast height) and age were measured of representative individuals of the dominant tree species. Physical site factors influencing vegetation such as exposure, soil moisture and depth to bedrock were noted. The potential community type and fire history were recorded as well as evidence of habitat use by wildlife.

Data collected during a 1980 caribou habitat study carried out by the Yukon Wildlife Branch (Map Sheets 105D•NE, 105D•SE, 105C•NW) was used to supplement the data base (Appendix J).

6.1.2 Defining Vegetation Communities

Vegetation community names (see Section 6.2) and descriptions were developed by grouping vegetation field data cards according to species

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[9]A draft methodology report submitted by C. Boyd (on file, Dept. of Renewable Resources, Government of Yukon) was used as a reference source.

VEGETATION AND WILDLIFE Date (Y/M/D) _____

Investigators _____ Site No. _____ Page ___ of ___

32. Dominant (Site) Community _____

33. Physiognomic Class _____

34. Composition and Coverage

STRATA	SPECIES	% COVER	VIGOR	STRATA	SPECIES	% COVER
Trees >5 m				Forbs		
Trees <5 m				Graminoids		
Tall Shrubs 1.5 to 5.0 m				Fern Group		
Medium Shrubs 0.5 to 1.5 m				Bryophytes		
Low Shrubs 0.1 to 0.5m				Lichens		
Ground Shrubs <0.1 m				Non-Vegetated		

35. Factors Influencing Vegetation

a) Exposure _____

b) Shallow to Bedrock _____

c) Soil Moisture Excess _____

d) Soil Moisture Deficiency _____

e) Other _____

Figure 29 Vegetation Field Data Card (front)

36. Tree Canopy Age (years): 0-25____ 25-100____ 100-200____ 200+____

37. Fire History - Age of Burn (s)_____

38. Potential Community_____ Physiognomic Class_____

39. Wildlife Habitat - Indicators of Wildlife Use

Species	Sightings	Droppings	Tracks	Nests/Dens	Feeding	Other

40. Photo Number (s)_____

41. Comments:_____

Figure 30 Vegetation Field Data Card (back)

composition, physiognomy and site characteristics.[10]

Although all the major communities had been sampled, it later became evident that some less dominant vegetation communities which were known to exist were not represented in the field data. (For distribution of ground sample sites throughout vegetation communities, see Appendix K). These communities were described and added to those derived from collected data.

Each community was assigned a name which would reflect the dominance and/or uniqueness of its composite species. Two or three of the most characteristic strata were identified using common names of the most descriptive species, overstory species preceding understory species (e.g. Lodgepole Pine/Kinnikinnick Willow-Shrub Birch/Grass-Sedge).

In treed communities, the most dominant tree species appears in the community name.

6.1.3 Vegetation Designators

Every unit of vegetation which could be effectively mapped at a scale of 1:100,000 was assigned a two-tier vegetation designator (Figure 21). The top tier indicates the zone; tree type (Hardwood, Softwood or Pine); tree height and tree density; and burn, where applicable. The bottom tier indicates the community type, discussed in Section 6.1.2.

The zone refers to the "biophysical" location of the unit, whether it is Alpine, Subalpine or Boreal. Elevation is the primary factor determining the zone, but other environmental factors (e.g. exposure, slope) play an influencing role.

In this study, Alpine (Zone 1) was considered to be that area above treeline, usually on mountain tops, characterized by prostrate shrubs, forbs, grasses and lichens. In the Southern Lakes treeline ranges between 1200 and 1350 meters a.s.l.

The transition zone between Alpine and Boreal (1250 to 1000 metres a.s.l.) was designated as Subalpine (Zone 3). Although the Subalpine is commonly a shrubland, white spruce and alpine fir frequently occur in scattered krummholz or closed stands.

The Boreal (Zone 6) typically occurs below 1050 metres a.s.l. It prevails over extensive areas at lower elevations and intrudes into valley bottoms in the Subalpine.

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[10]The assistance of Dr. E. Oswald of the Pacific Forest Research Centre, Environment Canada, Victoria, B.C. and C. Boyd, formerly of the Resource Inventory Program, Dept. of Renewable Resources, Government of Yukon are gratefully acknowledged in this regard. Dr. Oswald has worked extensively in the southwestern Yukon and has produced vegetation reports and maps on the East Kluane, Nisutlin, Ross River and Carmacks areas.

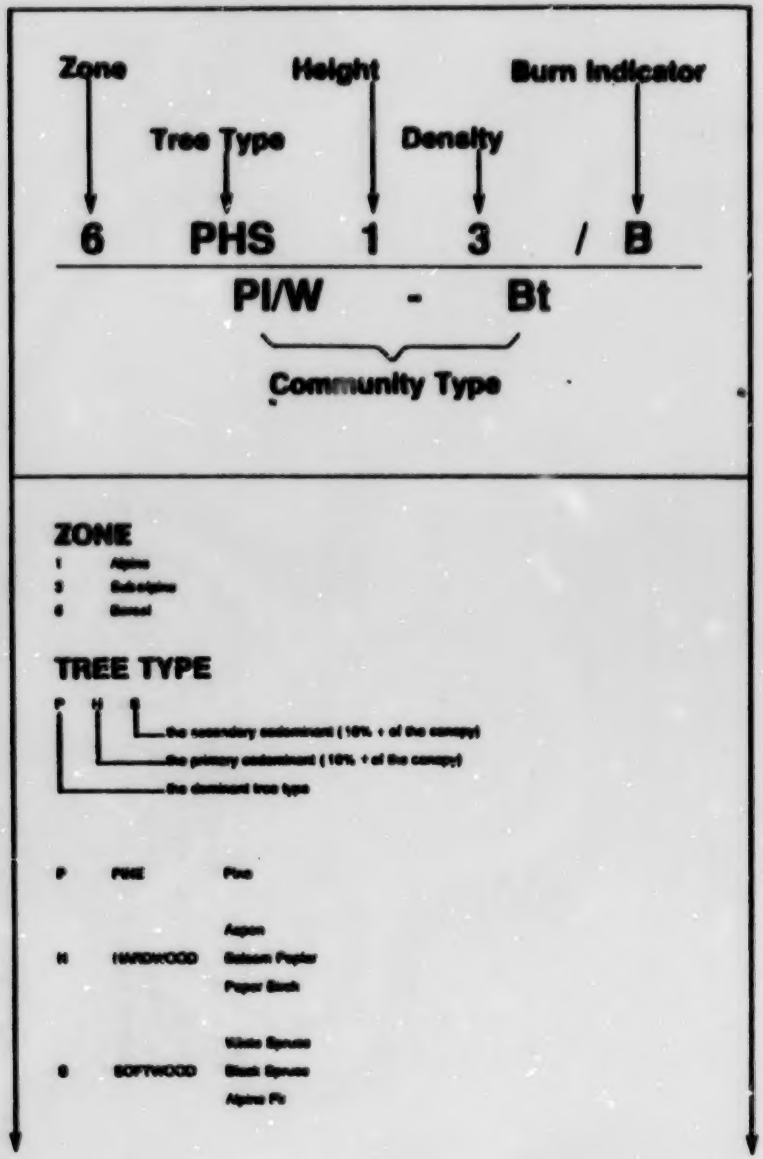

Figure 31 Vegetation Map Legend showing vegetation designators.

The three tree types divided tree species as follows:

(i) Pine - pine

(ii) Hardwood - aspen, balsam, poplar, paper birch

(iii) Softwood - white spruce, black spruce, alpine fir

Whenever pine could be distinguished with reasonable certainty from the other softwood species on the air photos, it was identified as such. The softwood type most often indicates white spruce.

All tree types comprising at least ten percent of the total tree canopy are indicated in order of dominance.

The height of the most dominant tree type is indicated by four classes (Fig. 31); classes 1 through 3 include heights between 0.0 and 27.5 metres with class 4 assigned to types exceeding 27.5 metres.

The percent crown closure (contributed by all tree types) ranges from 0 to 100 percent, distributed through classes 0 to 10 (Figure 31). Crown closures greater than 60 percent are uncommon.

The burn indicator, "B" refers to a regenerating burn in an early seral stage (Section 6.3).

6.1.4 Air Photo Interpretation

The surficial geology polygons were used as a basis for vegetation typing and as such, the geology polygon boundaries were transferred to a duplicate set of black and white air photos (Appendix G).

These photos were interpreted for vegetation units which could be mapped effectively at a scale of 1:100,000. If the vegetation units coincided with the geology units, the geology boundaries were left intact. Where more than one vegetation unit existed within a geology polygon boundary, those units were drawn in. If a vegetation unit did not closely resemble a geology boundary, then that boundary was erased and a boundary unique to the vegetation unit was drawn in.

As an aid to air photo interpretation, Landsat imagary (NTS corrected) was obtained for the study area at a scale of 1:100,000 in colour bands 4, 5 and 7. This was of great assistance in certain applications. By using known vegetation communities at field site locations as colour "standards", it was possible to map similar communities occurring elsewhere. This was particularly useful for delineating recent burns and other areas where pine (in an early seral stage) comprises the dominant cover. In the same manner, mature conifer stands could be clearly distinguished from shrublands and conifer stands of young age. Aspen was distinctly visible, even in mixed stands.

It should be noted that some discrete community types had not been sampled with enough frequency to permit detailed descriptions of site characteristics. In instances where ecologically significant site characteristics were insufficiently defined and key understory species were difficult to differentiate on the air photos (as was often the case in the Alpine, Subalpine shrubland or within identical tree species types), communities had to be lumped. For example, Sw/W-Bt/Fm and Sw/W-Bt/Li were often impossible to identify with a high degree of certainty and were simply designated Sw/W-Bt. Likewise, many shrublands had to be classified simply as W-Bt due to the uncertainty of assuming understory species.

6.1.5 Air Truthing

Air truthing was carried out by fixed wing aircraft in February and March 1982. Snow-covered ground proved to be a tremendous asset for determining conifer species and canopy densities of both hardwoods and softwoods, although understory species composition could not be verified. Post-flight adjustments were made to the typed air photos as required.

6.1.6 Map Production

Vegetation polygon boundaries and designators were transferred from the air photos to dylar contoured base maps at a scale of 1:100,000. These base maps were produced from reductions of NTS 1:50,000 scale maps with contour intervals of 100 feet (30 metres). Final boundaries were drafted onto stable base contoured mylar 1:100,000 maps and typeset designators were affixed in preparation for publication.

6.1.7 Preparation of Data for Computer Entry

The vegetation mapping data was prepared in a form that would facilitiate entry of information into CGIS (Canada Geographical Information System) of Canada Land Data Systems (CLDS) in Ottawa. Consecutive numbers were assigned to the vegetation polygons on each map sheet.

The polygon numbers and their corresponding designators were listed on polygon matrices. A scribe coat of the polygon boundaries was prepared as well as a transparent overlay showing the polygon numbers.

A matrix, a numbered polygon overlay and a scribe coat for every map sheet were entered into the information storage system at CLDS. This system allows computer data retrieval and manipulation and affords a wide range of uses and applications for resource planning and management.

6.2 Description of Vegetation Communities

D/G/Li Dryas/Grass/Lichen

This stable community occurs on mountain tops and high ridges, where exposure and permeable soils contribute to dry growing conditions.

Dryas (D. octopetala and *D. integrifolia)*, grass *(Hierochloë alpina, Poa,* spp.) and lichen *(Alectoria nigricans, Thamnolia vermicularis, Cetraria* spp., *Stereocaulon tomentosum)* dominate a sparse ground cover. Permafrost and patterned ground are not uncommonly associated with this alpine environment. (Plate 33)

W-Bt-D/Li Willow-Shrub Birch-Dryas/Lichen

Where alpine conditions are slightly less severe, prostrate shrubs (*Salix* spp., *Betula glandulosa, B. nana*) may establish, rarely exceeding 0.1 metre in height. Morainal and colluvial materials hold little moisture on these exposed, high elevation slopes. *Dryas (D. integrifolia, D. octopetala)* and lichen *(Cetraria cucullata, C. islandica, C. Richardsonii, Alectoria* spp., *Thamnolia vermicularis)* also characterize this stable community. Grasses *(Hierochloë alpina, Poa* spp.*)* and forbs are an important, though less dominant feature.

W-Bt-D/G Willow-Shrub Birch-Dryas/Grass

On high alpine sites where more moisture is available, grass replaces lichen. This stable community is frequently found on the lee side of alpine peaks or in and below cirque basins and nivation hollows where seepage is provided by late snow melt, persisting snow above or seasonal frost.

Species composition is similar to W-Bt-D/Li, but lichen is much less abundant than *Hierochloë alpina, Poa* spp. and other grasses. (Plate 20)

S-G/Li Sedge-Grass/Lichen

Moist to wet alpine situations often host a community of sedge *(Carex microchaeta, C. podocarpa)*, grass *(Poa* and other species*)* and lichen *(Cetraria cucullata, C. nivalis, C. Richardsonii, Alectoria* spp.*)*.

On steeper slopes, persisting snow or seasonal frost may account for these moist conditions, whereas on level sites or depressions drainage may be restricted due to frozen soil or bedrock, despite the porous nature of the colluvial or morainal surficial materials.

The presence of a stable graminoid community precipitates a well developed organic-mineral soil horizon in situations where soil formation is unrestricted (e.g. by bedrock).

W-D/S-G Willow-Dryas/Sedge-Grass

Prostrate willows (e.g. *Salix reticulata)* and *Dryas integrifolia* are the dominant ground shrubs in this stable alpine community which occurs on wet, high elevation rockfields, similar to S-G/Li. On north-facing slopes and other situations where snow may persist into summer, ericaceous shrubs *(Cassiope tetragona, Phyllodoce empetriformis* and *Empetrum nigrum)* and *Dryas octopetala* can occur. Mats of sedge (usually *Carex michrochaeta)* and grass cover a good portion of the ground. Lichens are absent or scarce.

W-Bt/Li Willow-Shrub Birch/Lichen (Subalpine)

This common subalpine type occurs over a wide range of ecological conditions except very wet and very dry. The underlying morainal and colluvial surficial materials support moderately to well-drained soils which may exhibit permafrost and patterned ground at higher elevations.

Betula glandulosa dominates the shrub layer while *Salix* spp. may or may not be present. *Cetraria cucullata, C. nivalis, Cladina rangiferina* and *Alectoria* spp. comprise over 20% of the total ground cover, with other lichens *(Dactylina artica, Thamnolia vermicularis* and *Stereocaulon* spp.*)* appearing less frequently.

Groundshrubs typically include *Dryas integrifolia, Vaccinium vitis-idaea,* and *Empetrum nigrum.* Krummholz white spruce or alpine fir occur occasionally.

W-Bt/D Willow-Shrub Birch/Dryas

This stable community is ecotonal between alpine and subalpine. It is found at high subalpine elevations (1200+ metres) often in association with shallow, rocky soils of morainal origin which are well to moderately drained.

Betula glandulosa is the dominant shrub though *Salix* spp. are usually present and often have a similar cover value. *Dryas* spp. appear consistently in combination with various ground shrubs including *Salix reticulata, Empetrum nigrum, Vaccinium vitis-idaea* and *Arctostaphylos rubra.*

A range of mountain forbs *(Lupinus arcticus, Saxifraga tricuspidata, Silene acaulis, Mertensia paniculata, Delphinium glaucum, Pedicularis capitata)* colonize the slopes. Grass *(Festuca altaica, Poa* spp.*)* and lichen *(Cetraria cucullata, C. nivalis, C. islandica, C. Richardsonii, Thamnolia vermicularis, Stereocaulon* spp.*)* constitute only a small part of the total ground cover.

W-Bt/G-S Willow-Shrub Birch/Grass-Sedge

This subalpine shrubland occurs on moist sites, often at the foot of solifluction slopes.

Betula glandulosa and/or *Salix* spp. underlain by grass *(Festuca altaica, Calamagrostis* spp.*)* and/or sedge *(Carex microchaeta)* characterize this

community. Shrubs range from 0.1 to 1.5 metres, with shrub height decreasing as elevation increases.

Groundshrubs may include heaths such as *Empetrum nigrum*, *Phyllodoce empetriformis* and *Cassiope tetragona*, as well as *Rubus chamaemorus*. Lichens are sparse. Krummholz white spruce or alpine fir occur occasionally.

W-Bt/G-S/Bm Willow-Shrub Birch/Grass-Sedge/Bog moss

Poorly drained situations in the lower subalpine give rise to this wet shrubland with its typically organic soil.

A dense cover (over 40 percent) of *Salix* spp. and/or *Betula glandulosa* dominate the community. Wetland grass and/or sedge and/or *Equisetum* spp. have a high cover value. Bog mosses and *Sphagnum* comprise over 30 percent of the ground cover.

This is a stable community. (Plate 34)

W-Bt Willow-Shrub Birch

This ubiquitous subalpine and boreal community is typically found on moderately well to well-drained, gently sloping sites between 1200 and 1500 metres. Many examples can be seen in the vicinity of Rose and Primrose Lakes.

The shrub layer can be extremely dense. In addition to the dominant shrubs (*Salix* spp. and/or *Betula glandulosa*), *Potentilla fruticosa*, *Sheperdia canadensis*, *Vaccinium uliginosum* and *Ledum palustre* may be present.

The ground cover is inconsistent and usually sparse. Various forb species occur depending on microsite conditions. Mosses and lichens are common.

Krummholz conifers may be scattered throughout.

Fa/W-Bt Alpine Fir/Willow-Shrub Birch

This subalpine type usually occurs on gentle to steep, well to moderately well-drained northeast facing slopes above 900 metres. Of the fir communities found in the Southern Lakes Region, this is the most common.

In this stable community, *Abies lasiocarpa* is the dominant tree species although *Picea glauca* is often a minor component of the canopy. Total crown closure is usually less than 40 percent.

The dominant shrubs, *Betula glandulosa* and *Salix* spp. (0.5-1.5 metres) are frequently accompanied by *Vaccinium uliginosum* and *Ledum palustre*. This erect shrub cover generally exceeds 25 percent. *Empetrum nigrum* and *Vaccinium vitis-idaea*, two prostrate, ericaceous shrubs, are usually present.

Groundcover is extremely variable. On mesic sites groundcover ranges from a high percent cover of feathermoss on deeper soils to a high percent cover of lichen on thinner soils. On wetter sites, bog moss dominates instead of feathermoss. In many situations where alpine fir might be expected it is replaced by white spruce, particularly in the western half of the study area. (Plate 35)

Fa/Fm Alpine Fir/Feathermoss

This is a stable subalpine community type occurring on well-drained soils on north and northeast facing slopes (though occasionally on southfacing slopes) above 1000 metres. It occurs infrequently outside of the eastern portion of the study area (e.g. South Canol Road).

Abies lasiocarpa is the dominant tree species, though *Picea glauca* may be present. With the tree canopy closure normally exceeding 45%, only a sparse, medium height shrub layer can be supported in the low available light. *Salix* spp. and/or *Betula glandulosa* may occur but with less than 20% cover.

Groundshrubs usually include *Empetrum nigrum* and *Cassiope tetragona*. Typical higher elevation forbs that occur are *Hedysarum alpinum, Mertensia paniculata, Lupinus arcticus, Senecio lugens, Pyrola secunda* and *Pedicularis sudetica*.

More that 50 percent of the ground is carpeted in feathermoss. Lichens *(Cladina mitis, Cladonia* spp., *Peltigera aphthosa)* may be present, typically growing on top of the moss.

Fa/Lg/Bm Alpine Fir/Labrador Tea/Bog moss

This type is found, albeit rarely, at lower subalpine elevations on north to east facing slopes. It is associated with wet crysolic soils.

Abies lasiocarpa is the dominant tree species, although *Picea glauca* and *Picea mariana* may also be present. In the erect shrub layer, *Ledum palustre* is the most prevalent species. Prostrate shrubs include *Vaccinium vitis-idaea* and *Empetrum nigrum*. 80% of the forest floor is carpeted in bog mosses which may have a high cover of fruticose lichens *(Cladina mitis, C. rangiferina, Cetraria cucullata)* growing on top.

Sw/Fm White Spruce/Feathermoss

This community commonly occurs on mesic sites, typically on till, alluvium or lacustrine soils. It is found from valley bottom to mid-slope on any aspect, but most frequently on level alluvial flats, gently rolling plains and lower slopes. Sites are moderately well drained or better, though usually not excessively drained.

This is one of the most productive white spruce communities, with a tree cover exceeding 50%. *Pinus contorta* and *Populus tremuloides* are occasionally interspersed in the canopy. An erect shrub understory is often lacking; when present it most always consists of sparse *Salix* spp. and *Rosa acicularis*.

Lush feathermoss *(Hylocomium splendens, Pleurozium schreberi, Ptilium crista-castrensis, Thuidium abietinum* carpets the forest floor. Caribou lichens and ground shrubs *(Vaccinium vitis-idaea, Empetrum nigrum)* grow in patches on top of the moss or where moss is absent. Trace amounts of shade-tolerant forbs such as *Pyrola secunda, Mertensia paniculata, Geocaulon lividum, Petasites frigidus* and *Cornus canadensis* are typical. *Equisetum* spp. may be present with a low to moderate cover.

Sw/Eq White Spruce/Equisetum

This boreal forest type appears on level, imperfectly to well-drained alluvial flats. The banks of the Nisutlin River host such forests, dominated with *Picea glauca* and accompanied by a few mature *Populus balsamifera* and *P. tremuloides*, remnants from an earlier successional age.

A carpet of feathermoss lies beneath an often dense cover of *Equisetum* spp. Grasses *(Calamagrostis* spp.*)* and forbs are common but shrubs *(Rosa acicularis, Viburnum edule)* occur less frequently.

Sw/Lb White Spruce/ Twinflower

This rarely occurring boreal type is found on moderately well to well-drained loamy soils, slightly drier than those associated with the ubiquitous Sw/Fm type which it resembles.

A relatively closed canopy (usually over 50 percent cover) of *Picea glauca* explains the absence of the shrub understory. The occasional *Salix* spp. or *Sheperdia canadensis* is seen. *Linnaea borealis* thrives in the low light, dominating the ground cover in association with feathermoss and/or lichen. Other shade-tolerant ground shrubs such as *Empetrum nigrum* and *Vaccinium vitis-idaea* may be present with a low cover value.

This community is a successional stage to Sw/Fm.

Sw/Bm White Spruce/Bog moss

Poorly to imperfectly drained sites at the base of slopes and in depressions often support this stable boreal community. These level or very gently sloping sites may be subject to seepage, permafrost, long persisting seasonal frost or occasional flooding.

Picea glauca dominates a fairly open canopy which usually has less than 50 percent crown closure. *Picea mariana* may also appear within this type in the Nisutlin and Teslin River drainages, but generally not in the Yukon River drainage. The medium height shrub layer usually consists of *Salix* spp. and *Betula glandulosa. Ledum palustre* is most characteristic of the low shrub layer; *Potentilla fruticosa* is consistently present though much less abundant. *Rosa acicularis* and *Sheperdia canadensis* may also appear.

The bog mosses which distinguish this community *(Tomenthypnum nitens Aulacomnium turgidum* and *A. palustre)* underlay various evergreen groundshrubs *Vaccinium vitis-idaea, Empetrum nigrum, Linnaea borealis)* as well as *Arctostaphylos rubra*. Sedge and/or *Equisetum* can occur. (Plate 37)

Sw/En White Spruce/Mossberry

This rarely occurring boreal community occurs on sloping sites with moderately well to poorly drained soils.

Picea glauca dominates the tree cover although *Pinus contorta* and/or the occasional *Populus tremuloides* may be present. The community often lacks a shrub understory; shrubs, when present, include *Ledum palustre, Potentilla fruticosa, Salix* spp. and *Rosa acicularis*. *Empetrum nigrum* comprises at least 10 percent of the groundcover.

Although this community resembles Sw/Fm, the feathermoss carpet is not as well developed (less than 40 percent cover) possibly due to cooler conditions found further upslope where Sw/En persists.

Sw/W-Bt White Spruce/Willow-Shrub Birch

This ubiquitous white spruce community occurs in both the boreal and subalpine under widely variable conditions.

Growing sites are as diverse as gleyed depressions at the base of slopes, annually flooded alluvial flats, subalpine morainal blankets and rapidly drained glaciofluvial landforms.

Picea glauca dominates this open treed community with a canopy cover usually under 30 percent. *Pinus contorta* may be present with a low percent cover. In the vicinity of Marsh Lake, *Betula papyrifera* can occur.

A high cover of medium height shrubs (mostly *Salix* spp.) characterizes this type. In less well-drained sites, *Ledum palustre* is often the dominant shrub.

Groundcover varies with the moisture regime from lichen on drier sites, to feathermoss on mesic sites, to bog moss on wetter sites.

In the western portion of the study area, this community predominates over Fa/W-Bt in the subalpine.

At lower elevations, Sw/W-Bt may be successional to Sw/Fm. (Plate 36)

Sw/Li White Spruce/Lichen

This stable boreal and subalpine community occurs on dry, sandy (coarse textured) sites that are well to rapidly drained, such as those afforded by morainal blankets, glaciofluvial channels and terraces, and stabilized sand dunes. It is also found on less well-drained sites which have a sandy surface and gentle

southerly slope.

The dominant tree, *Picea glauca*, has less than 50 percent cover. *Pinus contorta* frequently appears in the canopy.

If the medium and low shrub layers are present, they usually consist of a few sparse *Salix* spp. and *Betula glandulosa*.

The ground is well covered in lichens,(mainly *Cetraria cucullata, Stereocaulon* spp., *Cladina* and *Cladonia* spp.) though moss is rare. (Plate 38)

Sw/Ki White Spruce/Kinnikinnick

This community occurs on well to rapidly drained, deep sandy soils, usually of glaciofluvial, alluvial or eolian origin. It frequently occurs on the slopes of kame mounds and sand dunes, but not on the depressional bottoms associated with these landforms.

Picea glauca dominates the canopy although *Pinus contorta* and *Populus tremuloides* are often present as well. Erect shrubs *(Salix* spp.*)* are sparse. *Arctostaphylos uva-ursi* is the predominant groundcover species on these dry slopes. *Vaccinium vitis-idaea, Linnaea borealis* and *Rosa acicularis* occur regularly, but with low abundance. Forbs *(Achillea borealis, Mertensia paniculata, Epilobium angustifolium)* are found only in trace amounts.

Although the Southern Lakes region affords ample sites suitable for the development of this community, its occurrence is relatively low due to fire. A successional pine community commonly appears in its stead.

Sw/Sc White Spruce/Soapberry

This boreal community is found on moderately well to well-drained sites, usually indicative of a successional transition from aspen to white spruce. It may be maintained through grazing disturbance or periodic flooding in alluvial situations.

Picea glauca dominates the canopy, but a few *Populus tremuloides* are always present. More than 15 percent of the ground is covered by *Sheperdia canadensis*, the primary shrub species; *Salix* spp. are also present. Groundshrubs *(Arctostaphylos uva-ursi, Linnaea borealis)* are sparse. Forbs may include *Geocaulon lividum, Mertensia paniculata, Epilobium* spp. and *Zygadenus elegans*. The presence or absence of feathermoss and lichen is dependent upon the moisture regime of the site.

Sw/Sc is successional to Sw/Fm or Sw/Li.

Sw/Nd White Spruce/Nudum

Although of limited distribution, this type occurs in dry situations throughout the boreal zone. Understory development is restricted due to acidity or lack of moisture. This community may occur in association with a high tree density or heavy squirrel usage.

Picea glauca is the dominant species with *Pinus contorta* a frequent co-dominant of lesser cover value. Conifer needles litter a forest floor which supports few erect shrubs (e.g. *Salix* spp.) and only trace amounts of ground-shrubs *(Empetrum nigrum, Vaccinium vitis-idaea, Arctostaphylos uva-ursi, A. rubra, Linnaea borealis)* lichens and feathermoss.

This type can be successional to Sw/Li or Sw/Ki.

Sw/G White Spruce/Grass

This stable community is established on well drained soils, frequently occurring on south-facing slopes in the boreal and subalpine.

Picea glauca is the dominant species in an open canopy. *Abies lasiocarpa* or *Populus tremuloides* may appear as well, depending on site conditions (i.e. aspect, elevation, moisture).

Medium height shrubs (e.g. *Salix glauca)* constitute a low percent cover. Low-moisture adapted groundshrubs *(Arctostaphylos uva-ursi, Juniperus horizontalis, J. communis)* are more commonly seen, along with *Linnaea borealis.*

The grassy slopes *(Festuca altaica, Calamagrastis purpurascens, Poa* spp.*)* which distinguish this spruce type are scattered with forbs such as *Zygadenus elegans* and *Pulsatilla patens.*

Sw/D White Spruce/Dryas

This subalpine community resembles the alpine *Dryas* communities, except that *Picea glauca* has managed to invade. The tree cover is sparse on typically well-drained slopes. *Salix* and/or *Betula glandulosa* generally comprise the low-medium shrub understory. *Dryas* is the prominent groundcover species, occurring along with grass and/or lichen.

Sb/Lg Black Spruce/Labrador Tea

This stable community is the least moisture-tolerant in a gradient of black spruce types. This community is found on moist (crysolic, gleysolic or humic) soils, often associated with permafrost or long persisting seasonal frost. It can occur on morainal, colluvial or lacustrine materials in poorly drained situations at the base of slopes and in depressions.

Picea mariana dominates the canopy (15-40 percent cover), occasionally joined by *Picea glauca*. *Salix* spp. comprise a sparse medium height shrub understory *Ledum palustre* thrives under this moisture regime, with a cover exceeding 20 percent. *Rosa acicularis* and *Vaccinium uliginosum* may be present.

A well-developed bog moss layer sometimes includes the wetter *Sphagnum* moss. A considerable lichen cover (15 percent), primarily *Cladina mitis*, distinguishes this community from the other black spruce types. *Vaccinium vitis-idaea, Empetrum nigrum* and *Arctostaphylos rubra* grow on or through the moss carpet. (Plate 39)

Sb/Bm Black Spruce/Bogmoss

Intermediary between Sb/Lg and Sb/Sp, this black spruce community is found on gleyed (imperfectly to poorly drained) soils which may have long persisting seasonal frost. Organic or lacustrine deposits on lower slopes and depressions frequently underlie these soils.

Picea mariana is the dominant tree species (up to 40 percent cover), although occurrences of *Picea glauca* in the canopy are not uncommon. Shrubs are rare. Lichens grow sparsely on the extensive carpet of bog moss.

Sb/Sp Black Spruce/Sphagnum

This black spruce community is most tolerant of wet sites, especially those with underlying permafrost.

It is typically found on imperfectly to very poorly drained organic soils at the foot of slopes and in depressions, on peat plateaus and palsas. Suitably moist morainal, lacustrine, alluvial and glaciofluvial soils can also support this community.

Tree cover is sparse (less than 15 percent), usually consisting only of *Picea mariana*. Varying densities of *Salix* spp. and *Betula glandulosa* appear in the medium shrub layer. *Ledum palustre* dominates the lower understory, often in combination with *Potentilla fruticosa, Vaccinium uliginosum* and *Salix* spp.

A deep, well-developed blanket of *Sphagnum* covers these characteristically hummocky sites, supporting various groundshrubs *(Empetrum nigrum, Vaccinium vitis-idaea, Arctostaphylos rubra)* and the occasional lichens *(Cladonia* spp.*)*.

Pl/W-Bt Lodgepole Pine/Willow-Shrub Birch

This type is established over various mesic to well-drained soils on valley floors, plains and gentle slopes at lower elevations and occasionally in the subalpine.

A dense canopy of *Pinus contorta* (over 50 percent cover) frequently includes *Picea glauca*. Tree cover can be much reduced at higher elevations.

This forest hosts a well developed shrub understory, comprised mainly of *Salix* spp. and/or *Betula glandulosa*. Willow predominates earlier successional stages but tends to be the first to drop out as succession advances. The lower shrub layer may have a considerable amount of *Ledum*. Grasses *(Festuca altaica, Poa* spp., *Calamagrostis* spp.*)* are a consistent feature, though low to moderate in cover value.

This is a community successional to Sw/W-Bt or Sw/Fm. (Plate 40 shows Pl/W-Bt as an early successional stage following fire).

Pl/Li Lodgepole Pine/Lichen

This community is adapted to the coarse textured, rapidly drained soils of outwash terraces, kames and sand dunes.

Pinus contorta can form a fairly continuous canopy, though a 15-35 percent cover is most typical. *Picea glauca* is a frequent cohort, of lower cover value.

A shrub understory is characteristically lacking; scattered *Salix* spp. may be present. Patches of *Empetrum nigrum* are of sparse but regular occurrence.

The forest floor takes on a snowy appearance with caribou lichen (primarily *Cladina mitis*) cover exceeding 40 percent. Other lichen species include *Cladina stellaris, C. rangiferina, Cladonia* spp. and *Stereocaulon* spp.

This boreal Pl/Li type can maintain itself as a stable community on very dry, sandy sites. However, it may also be successional to Sw/Li, or at least related ecologically. (Plate 41)

Pl/G Lodgepole Pine/Grass

This community is generally found in mesic situations on loamy soils, which can have an eolian veneer. South-facing slopes and well-drained plains and valley floors support this type.

Pinus contorta dominates the canopy, although *Populus tremuloides* and *Picea glauca* may also occur. The tall and medium height shrub layers may be absent or comprised of a low to moderate cover of *Shedperdia canadensis* and trace amounts of *Salix* spp. Low shrubs are scarce, but include *Rosa acicularis, Viburnum edule* and *Salix* spp.

Groundshrubs *(Arctostaphylos uva-ursi, Linnaea borealis* and *Vaccinium vitis-idaea)* occur in varying densities from low to moderate. The grasses which typify this community *(Festuca altaica, Calamagrostis purpurascens, Poa* spp., *Agropyron canium, Bromus Pumpellianus)* vary in their composition and percent cover.

This type has a fire history and may be found on burnt lacustrine soils, such as those in the Carcross road area. It is usually successional to Sw/Li or Sw/G, but is possibly maintained at the Pl/G stage due to grazing. (Plate 42)

Pl/Ki Lodgepole Pine/Kinnikinnick

This diverse community occupies sites that are mesic or drier, with a moisture regime between that of Pl/Li and Pl/G. Often found on southerly slopes, it is characterized by loamy to sandy soils of lacustrine, eolian or glaciofluvial origin. Pl/Ki has an unusual tendency to prevail in areas subject to strong winds, such as Carcross.

Pinus contorta, the major tree species, is frequently joined by *Picea glauca* and/or *Populus tremuloides* to form a canopy usually with 30 - 60 percent cover. The understory is absent of tall and medium height shrubs except for trace amounts of *Salix* spp. *Viburnum edule* occurs occasionally along with the more common *Sheperdia canadensis* and *Rosa acicularis* in the low shrub layer.

The dominant ground cover feature, *Arctostaphylos uva-ursi*, is accompanied by other evergreen shrubs such as *Linnaea borealis*, *Vaccinium vitis-idaea* and *Empetrum nigrum*. Forbs may include *Cornus canadensis*, *Epilobium angustifolium*, *Lupinus arcticus*, *Zygadenus elegans* and *Mertensia paniculata*.

Mosses are absent except for *Polytrichum* spp. Only trace amounts of lichen (*Cetraria* spp., *Stereocaulon* spp. and *Peltigera* spp.) are present.

This community is related and usually successional to Sw/Li and Sw/G. (Plate 43)

Pl/Nd Lodgepole Pine/Nudum

This boreal community establishes on well to rapidly drained sites with coarse textured (sandy to loamy) soils. Pl/Nd is most common on low elevation plains, valley floors and gentle to moderate south-facing slopes.

The term nudum refers to the distinct lack of understory development. A high tree density (hence little available light) coupled with dry edaphic conditions inhibits growth under the canopy.

Crown closure of *Pinus contorta*, the dominant species, is generally over 50% and may reach 80%. Occasionally *Picea glauca* appears in the canopy as well.

Trace amounts of tall *Salix* or low shrubs (*Sheperdia canadensis*, *Rosa acicularis*) occur.

This community is easily recognized by the pine needles that completely litter the forest floor. Groundshrubs (*Linnaea borealis*, *Arctostaphylos uva-ursi*) and forbs (*Epilobium angustifolium*, *Lupinus arcticus*) are rare or absent. Lichens (*Cladonia* spp., *Peltigera* spp.) and mosses (dry - tolerant species such as *Polytrichum* spp.) are scarce.

This is probably a successional stage to Sw/Li.

Pl/Fm Lodgepole Pine/Feathermoss

This is a community of widespread occurrence throughout the Southern Lakes, typically found on level or gently sloping sites that are moderately well drained.

A closed canopy of *Pinus contorta* (usually over 50% cover) may include a low percentage of *Picea glauca*. Only a few scattered *Salix* spp. and *Alnus crispa* appear as tall shrubs. The medium height shrub understory, if present, amounts to a low percent cover of *Betula glandulosa*, *Salix* spp., *Alnus crispa* and/or *Viburnum edule*. By contrast, *Ledum palustre* alone can account for 20 percent cover in the low shrub layer and may be accompanied by *Vaccinium uliginosum*, *Sheperdia canadensis* and *Rosa acicularis*.

Evergreen groundshrubs *(Vaccinium vitis-idaea*, *Empetrum nigrum* and *Linnaea borealis)* are common.

Over 60 percent of the ground is carpeted in feathermoss. Caribou lichens may be present.

This boreal community is successional to Sw/Fm.

Pl/Al Lodgepole Pine/Alder

Of limited distribution, this distinct boreal type seems to be associated with soils of relatively high productivity, often of alluvial or morainal origin (e.g. till).

Such sites host dense stands of *Pinus contorta*, (frequently joined by *Picea glauca*) with crown closures often exceeding 60 percent.

The understory is typified by *Alnus crispa*, which appears as a tall shrub with over 30 percent cover. Shrubs of medium height are absent, while only trace amounts of *Ledum palustre* occur in the low shrub layer. Usually the only ground-shrub species is *Vaccinium vitis-idaea*. Forbs are rare. The ground is covered in moss *(Polytrichum* spp.*)* and lichen *(Cladonia* spp.*)*.

This community is successional to Sw/Fm.

Pt/Ki Aspen/Kinnikinnick

This community may occur in subalpine depressions where snow accumulates on otherwise rapidly drained, often rocky sites. Alternatively, it can be found in the boreal zone on active and stabilizing sand dunes, with their rapidly drained soils.

The canopy cover (dominated by *Populus tremuloides*) is usually greater than 25 percent. Tree height rarely exceeds 5 metres and is much less (2 to 3 metres) at higher elevations.

Low to moderate densities of *Salix* spp., *Betula glandulosa* and *Juniperus communis*

comprise the shrub understory.

A moderate to high groundcover (over 40 percent) of *Arctostaphylos uva-ursi* is a prominent feature of this community. Grasses *(Calamagrostis neglecta, Calamagrostis purpurascens, Festuca altaica)* are usually present with a low percent cover.

Pt/Ki often occurs in units too small to be mapped at a scale of 1:100,000.

This type is successional to Sw/Ki.

Pt/Sc-Ki Aspen/Soapberry-Kinnikinnick

This boreal community establishes on well to rapidly drained, coarse textured soils characteristic of eolian , alluvial and glaciofluvial (outwash) deposits. It commonly occurs throughout the Southern Lakes on steep south-facing aspects of eskers, drumlins, river banks and terraces.

Populus tremuloides is the dominant tree, though *Populus balsamifera, Pinus contorta* and *Picea glauca* occur in lesser and varying amounts.

Sheperdia canadensis usually dominates the erect shrub understory, interspersed with *Rosa acicularis* and the occasional *Viburum edule.*

30 to 80 percent of the ground can be covered in *Arctostaphylos uva-ursi. Linnaea borealis* also contributes a low percent of the groundcover. The numerous forbs which occur on these xeric slopes include *Achillea borealis, Lupinus arcticus, Zygadenus elegans, Arnica* spp., *Delphinium glaucum, Solidago multiradiata,* and *Epilobium angustifolium.*

Grasses may be present *(Festuca altaica, Agropyron* spp., *Calamagrostis purpurescens* and *Bromus Pumpellianus)* but with a low cover value. Mosses and lichens are rare. This type frequently establishes following fire and is probably successional to Sw/G.

Pt/G Aspen/Grass

This aspen community is typically found on steep, southerly aspects of river channels and kames in association with Pt/Sc-Ki and Sg/G. The Sage/Grassland community persists on more windswept exposures whereas Pt/G tends to occur in drainage channels which retain snow.

Pt/G can also occur on other rapidly drained sandy soils of alluvial, eolian or glaciofluvial origin as well as on lacustrine materials, especially calcareous soils that have been burnt.

The dominant tree, *Populus tremuloides*, is usually under 5 metres in height at boreal elevations and more stunted in the lower subalpine. Species composition resembles Pt/Sc-Ki, except the cover values of *Sheperdia canadensis* and *Arctostaphylos uva-ursi* are much reduced. Grasses *(Festuca altaica, Calamagrostis purpurescens, Bromus Pumpellianus* and *Agropyron* spp.*)* dominate the understory.

This type is of limited distribution throughout the Southern Lakes, often occurring in units too small to be mapped at a scale of 1:100,000.

It is successional to Sw/G. (Plate 44)

Pt/W-Bt Aspen/Willow-Shrub Birch

This aspen community of variable composition occurs on rock outcrops, windblown knolls and steep southwest-facing slopes at both boreal and subalpine elevations.

Populus tremuloides is the primary tree species, with *Populus balsamifera* and *Picea glauca* also appearing in the canopy.

The shrub understory is dominated by *Salix* spp. and *Betula glandulosa*; other shrubs *(Ledum groenlandicum, Juniperus communis, Arctostaphylos uva-ursi)* occur in varying amounts.

Forbs *(Epilobium angustifolium, Lupinus arcticus)*, grasses *(Festuca altaica, Calamagrostis purpurascens)*, lichen *(Peltigera* spp.*)* and *Lycopodium* spp. comprise a variable groundcover.

Though not uncommon, this type occurs in narrow units usually too small to be mapped at a scale of 1:100,000.

It is probably successional to Sw/W-Bt.

Pt/Ve Aspen/Highbush Cranberry

This type occurs most often on southwest aspects with 15 to 30 percent slope. Soils are mesic to dry, usually originating from till or colluvium.

The canopy of *Populus tremuloides* may be thin to fairly dense, varying from 40 to 80 percent cover. *Viburnum edule* dominates the shrub understory which typically includes lesser amounts of *Sheperdia canadensis* and *Ribes* spp. Forbs *(Mertensia paniculata, Epilobium angustifolium,* Composites) are common.

This boreal community is of limited distribution and, like other aspen types, occurs in small units that often cannot be mapped at a scale of 1:100,000.

It is successional to Sw/Li or Sw/G.

W/S Willow/Sedge

This boreal type occurs on imperfectly to very poorly drained gleysolic soils, usually with free water at the surface for a significant portion of the growing season or longer. It is found on alluvial sites subject to annual flooding or in depressions where water tends to stagnate; these latter sites have not yet developed into bogs, but rather are still at the fen stage.

A dense cover (usually over 50 percent) of medium height *Salix* spp. characterizes this community. *Betula glandulosa* may be present with a low cover value. Sedges (*Carex aquatilis* and other *Carex* spp.) dominate the understory with more than 50 percent cover. Bog mosses may be present. (Plate 6)

W/Eq Willow/Equisetum

This community occurs on deltas and lower floodplains, as well as along the margins of rivers. Periodic flooding characterizes most sites, though their drainage regimes may range from rapid to poor. Soils are typically of recent origin (e.g. alluvial, organic and mineral).

Salix spp., the dominant shrub, is usually over 1.5 metres in height and may grow in association with *Populus balsamifera* and/or *Picea glauca*. A dense groundcover of *Equisetum* spp. (over 50 percent) is a prominent feature, sometimes interspersed with *Carex* spp.

W/Eq is typical of the early stages of succession on alluvial sites, progressing from denuded gravel bars to a climax forest of White Spruce/Feathermoss.

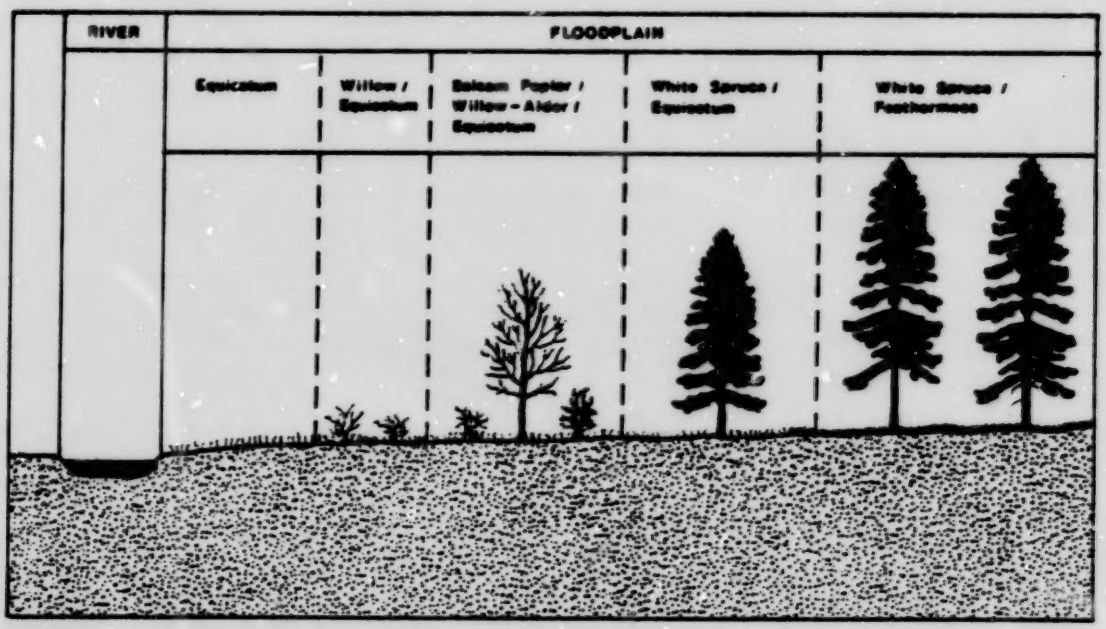

Fig. 32 Schematic diagram of a successional sequence from *Equisetum* to White Spruce/Feathermoss, on an alluvial site.

W/W Willow >.5 m/Willow <.5 m

This community is found on imperfectly to poorly drained gleysolic and sometimes crysolic soils of recent alluvial origin, typically on valley floors subject to frequent flooding.

The taller willows in this dense shrubland are likely to be *Salix glauca* and the lower ones *Salix myrtillifolia*. *Equisetum* spp. and bog moss may be present.

This type can be successional to Sw/Fm or Sw/Bm depending on the moisture regime, but may be maintained by seasonal flooding.

W/Ki Willow/Kinnikinnick

This community occurs infrequently at boreal elevations on well to excessively drained sandy sites on level to moderate southwest-facing slopes. Scant occurrences are found in the subalpine on well-drained glacial outwash.

A typically dense shrubland of tall *Salix* spp. (over 40 percent cover) may be interspersed with the occasional *Pinus contorta* or *Picea glauca*. *Shepardia canadensis*, *Viburnum edule*, *Rosa acicularis* and *Juniperus communis* appear in the lower shrublayers.

Groundshrubs usually include varying amounts of *Linnaea borealis* and *Arctostaphylos uva-ursi*. Mosses are almost absent (sparse *Polytrichum* spp. do occur) on these xeric sites but lichens *(Cladonia* spp. and *Stereocaulon* spp.*)* establish with a low to moderate percent cover.

This type is a successional state (possibly to Sw/Ki and Sw/Li) but rate of succession may be retarded due to the combined effect of dry conditions and lack of tree propagules.

W-Bt/Bm Willow-Shrub Birch/Bog moss

This community can be found on almost any imperfectly to poorly drained site from the boreal to the high subalpine across a wide range of soils (lacustrine, organic, mineral, glaciofluvial, recent alluvial, morainal, colluvial). It commonly occurs on depressions and lower slopes in association with long persisting seasonal frost and frequently, permafrost.

Low and medium height *Betula glandulosa* and/or *Salix* spp. dominate the shrub-cover (over 50 percent) but other moisture-tolerant low shrubs such as *Potentilla fruticosa*, *Ledum palustre*, and *Vaccinium uliginosum* are typical.

W-Bt/Bm resembles Willow/Sedge except the somewhat drier conditions permit groundshrubs *(Salix* spp., *Arctostaphylos rubra*, *Empetrum nigrum)* to establish. *Rubus chamaemorus*, *Rubus acaulis*, *Petasites* sp., *Mertensia paniculata* and *Senecio* sp. thrive on these moist sites.

A moderate cover of sedge (*Carex* spp.) is seen in association with an extensive carpet (over 50 percent cover) of bog moss. *Sphagnum* spp. may also be present. Lichens are rare.

Though ubiquitous, this type often occurs in pockets too small to be mapped at a scale of 1:100,000.

W-Bt/Li Willow-Shrub Birch/Lichen (Boreal)

This boreal phase of W-Bt/Li is associated with wetlands (ponds, lakes, drainages, etc.) where tree invasion is restricted due to a high water table, organic and/or crysolic soils, cold air drainage, frost pockets or a combination of these. Usually there is no free water at the surface.

A dense shrubland of *Betula glandulosa* (over 50 percent cover) may include some *Salix* spp. Occasionally, scattered *Pinus contorta* or *Picea glauca* have established. Groundshrubs and forbs are rare.

The community is characterized by a well developed layer of caribou lichens (over 30 percent cover of *Cladina mitis, C. rangiferina, Cetraria cucullata, C. nivalis*) supported by a carpet of bog moss and litter. The ground cover is physiologically dry despite an otherwise wet environment.

This is a relatively stable boreal community. Another phase of W-Bt/Li occurs in the subalpine.

W-Bt/G Willow-Shrub Birch/Grass

This shrubland is typically found on level and gently sloping sites that are moderately well to imperfectly drained, such as lacustrine plains.

Medium height *Salix* spp. and *Betula glandulosa* comprise a closed shrubcover of over 50 percent. Groundshrubs *(Vaccinium vitis-idaea, Arctostaphylos uva-ursi* and *Empetrum nigrum)* are usually present though sparse. A significant portion of the ground (over 30 percent) is covered with grass *(Calamagrostis purpurescens, C. neglecta, Descurainia beringensis, Festuca altaica)* interspersed with a variety of forbs. (Plate 45)

This relatively stable community is not of common occurrence.

Sg/G Sage/Grass

This boreal type is adapted to the xeric conditions found on steep, south-facing slopes of river channels, kame deposits and other glaciofluvial landforms, with their coarse, sandy, excessively to well-drained soils. These slopes are windswept and almost bare of snow in winter, which further contributes to the moisture deficiency.

Artemisia frigida is the most prominent species though it may not occur with a high percent cover. Other shrubs occurring with less frequency include *Arctostaphylos uva-ursi* and *Juniperus communis*. Grasses *(Agropyron* spp., *Calamagrostis purpurescens)* dominate the groundcover; dry-adapted forbs include *Pulsatilla patens, Saxifraga* sp., *Polemonium pulcherrim, Achillea millefolium, Sedum rosea* and *Solidago multiradiata.*

This stable community is found throughout the Southern Lakes but usually occurs in units too small to be mapped at a scale of 1:100,000.

S/Wm Sedge/Wetland Moss

Where standing water persists for long periods of time, this wetland community may establish. Such sites are found on level plains and valley floors in the boreal zone on imperfectly to very poorly drained organic and mineral soils.

This stable type may also occur on poorly drained alluvial soils of recent origin subject to annual flooding.

Carex aquatilis is the dominant species but other graminoids (*Eriophorum* spp. in particular) may appear as well. Trace amounts of *Picea mariana* and moisture-tolerant shrubs (*Potentilla fruticosa, Salix* spp. and *Betula glandulosa*) are typical. The ground is often covered in wetland moss (*Fontinalis antipyretica, Drepanocladus* spp., *Calliergon* spp.). (Plate 46)

G/Li Grass/Lichen

This community occurs across a broad range of site conditions and elevations, but most commonly on level to gently sloping boreal sites that are imperfectly to well-drained, possibly in association with high alkalinity or salinity. However, it is also found on old alluvial and till materials that are not generally considered alkaline. G/Li is occasionally found in the subalpine over well drained glacial outwash on hummocky and ridged terrain.

Over 40 percent of the ground is covered by grasses, characteristically *Calamagrostis purpurescens, C. neglecta, Hordeum jubatum, Agropyron* spp., and/or *Festuca* spp. Forbs (*Achillea borealis, Artemisia* spp., *Solidago* sp.) and shrubs (*Arctostaphylos uva-ursi,* low *Betula glandulosa, Salix* spp.) may be scattered throughout this grassland. Lichens are not necessarily present, but when they are they usually cover a significant portion (more than 40 percent) of the ground.

Plate 33 Dryas/Grass/Lichen
- mat growth forms are characteristic of this high elevation community

Plate 34 Willow-Shrub Birch/Grass-Sedge/Bog moss
- near Summit Creek Pass, southwest of Mount Hodnett

Plate 35 Alpine Fir/Willow-Shrub Birch
- alpine fir is more common in the eastern portion of the study area, such as this subalpine site in the Big Salmon Range

Plate 36 White Spruce/Willow-Shrub Birch
- this community is found along the margins of rivers (such as the lower McClintock shown here) and is successional to White Spruce/Feathermoss further from shore

Plate 37 White Spruce/Bog moss

- poor drainage and permafrost or long persisting seasonal frost are characteristic of the sites which maintain this community

Plate 38 White Spruce/Lichen

- coarse textured materials of glaciofluvial outwash support this community of white spruce and lichen; shrubs are scarce

Plate 39 Black Spruce/Labrador Tea

- permafrost or long persisting seasonal frost is often associated with this black spruce type

Plate 40 Lodgepole Pine/Willow-Shrub Birch

- this site near Snafu Lake was burned in 1958 (photographed in 1980); the pine region is interspersed with thick willows; compare with Plate 42

Plate 41 Lodgepole Pine/Lichen
- well-drained moraínal materials maintain this community near Millhaven Bay; understory is sparse

Plate 42 Lodgepole Pine/Grass

- this site in the Ibex Pass was burned in 1958; the present regen (photographed in 1980) is likely successional to White Spruce/Grass; compare with Plate 40

Plate 43 Lodgepole Pine/Kinnikinnick
- sand dunes near Carcross; Bennett Lake visible in background

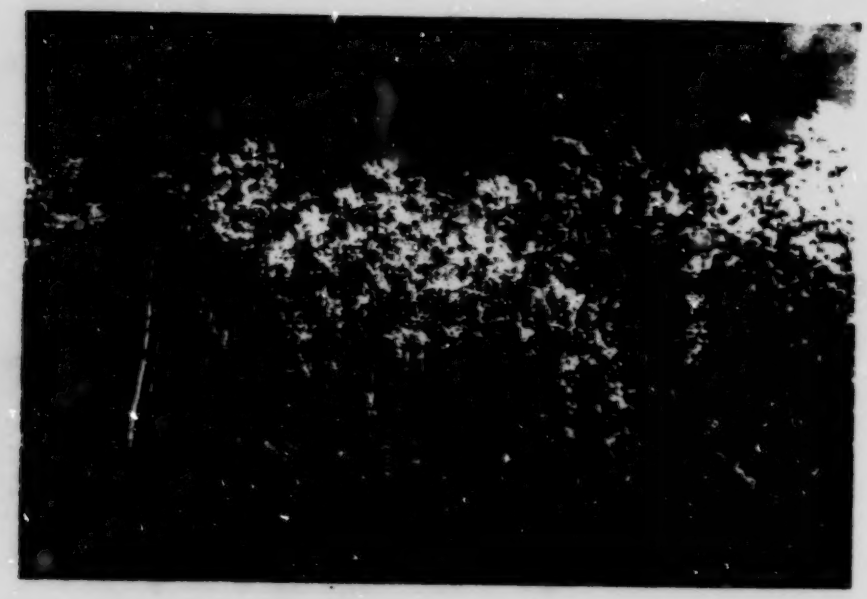

Plate 44 Aspen/Grass
- the steep south-facing slopes of eskers are typically colonized by aspens, grass and numerous forbs

Plate 45 Willow-Shrub Birch/Grass
- of limited distribution, this community establishes on level boreal sites that are moderately to imperfectly drained

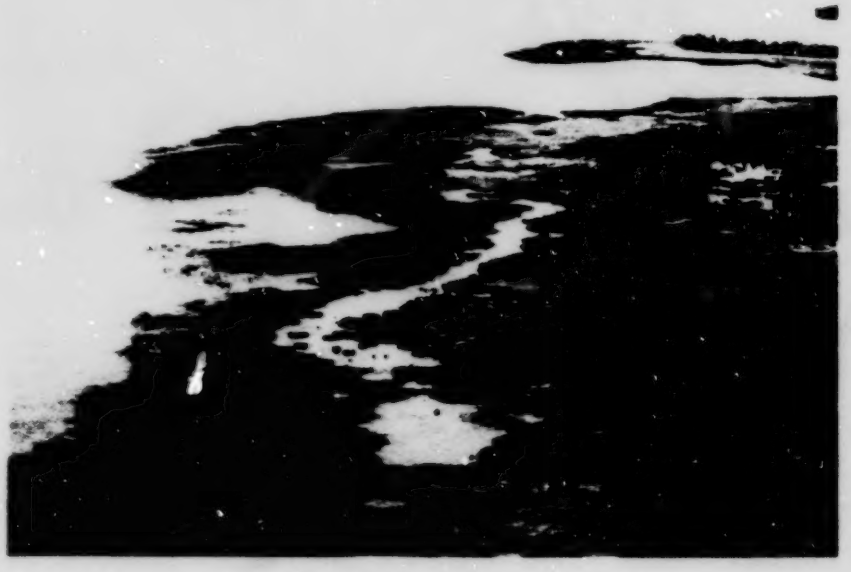

Plate 46 Sedge/Wetland moss
- Little Atlin Lake shoreline maintains this community in areas where standing water persists for long periods of time

6.3 Burns and Successional Communities

Fires have been, and continue to be, the most influencial factor underlying the mosaic of vegetation communities which comprise the Southern Lakes Region.

A broad age spectrum of regenerating burns can be found throughout the study area. The less obvious older regen can be recognized by the even age structure and usually homogenous composition of tree stands, primarily pine. Burns in earlier seral stages are typically invaded by a variety of deciduous shrubs and young conifers. (Plate 40)

On the vegetation maps which accompany this report, the letter "B" was used to designate burns in an early seral stage. It may appear with the following community types:

W-Bt	Willow-Shrub Birch
W-Bt/G	Willow-Shrub Birch/Grass
Pl/W-Bt	Pine/Willow-Shrub Birch
Pl/G	Pine/Grass
Pl/Ki	Pine/Kinnikinnick
Pt/G	Aspen/Grass

"B" appears most frequently in association with pine. This pine regen, usually less than five metres in height, may occur on a variety of lower elevation sites with a diverse understory vegetation. Pine usually does not establish on lacustrine or at least alkaline soils, but there are few other restrictions providing a seed source is available following the fire.

In other instances, a dense growth of deciduous species such as willow and aspen can dominate following fire, precluding pine from establishing. At higher elevations, shrub birch is the most prevalent regen.

White spruce can form the dominant regen after fire rather than pine on certain lacustrine or loamy soils, as opposed to the drier soils where pine prevails. White spruce regen is not common in the Southern Lakes though small occurrences can be found in the vicinity of the Takhini River.

The frequency of fires is such that the successional sequence is often prevented from proceeding all the way to white spruce - the climax species of the Southern Lakes boreal forest - and thus pine maintains itself as the dominant species of the region.

Two major fires took place in 1958 (H. Patterson, pers. comm.[12]) which burned a significant portion of the study area: the Takhini burn to the northwest, extending north and south of the Takhini River and into the Ibex Valley (map sheet 105D•NW); and the Teslin burn to the southeast, extending from Little Atlin Lake to Teslin Lake (map sheets 105C•SW and 105C•SE).

The variability of regenerating vegetation in these concurrent burns is an engaging study in plant succession and the associated effects of microsite conditions and burn intensity.

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[12]Harold Patterson; former Forest Ranger, Northern Affairs Program, Government of Canada, Whitehorse, Yukon.

7. AQUATICS

7.1 Methods

The aquatic inventory system used in this project addressed the physical characteristics and processes and the biological attributes of the aquatic resources. Bio-physical measurements and descriptions were collected at a reconnaissance level from which a variety of interpretive products will be generated. There were two main components of the system, one dealing with rivers and streams and the other dealing with lakes.

The data and data collection techniques differ for inventorying rivers and lakes, however a similar systematic process is followed:

A) Pre-Field Activities

1. Pre-typing air photos, reach breaks and obvious features
2. Reviewing and compiling existing information

B) Field Activities

1. Low level flights with aerial descriptions, mapping of features and ground sites.
2. Ground sampling.

C) Post-Field Activities

1. Review air photos and aerial descriptions
2. Prepare and enter data into computer
3. Map preparation and drafting
4. Report generation

7.2 Rivers and Streams

The inventory system used to collect the baseline information was adopted from the system used in the province of British Columbia (Chamberlin, 1980). The system has been used extensively in B.C. for collecting reconnaissance level bio-physical information on streams and rivers. For reasons of consistency it was decided to use the same inventory system. This system also has an elaborate computer program for the entry and processing of the inventory information which were made available to this project. A variety of computer-generated reports are available for reach, point, fish and stream feature data. Brief descriptions of methodology will be given here but complete documentation of terminology and data entry procedures are available through the Resources Planning and Management Branch, Government of Yukon, or contact the Aquatic Studies Branch, Ministry of Environment, Government of British Columbia, Victoria, B.C.

7.2.1 Watershed Code Numbers

The study area has been divided into watersheds and an hierarchical watershed numbering system has been used to individually identify each stream or channel (Shera, Grant, 1980). All data is referenced for storage and retrieval through the watershed code number. See Appendix L for a complete list of the watersheds studied with corresponding watershed code numbers.

7.2.2 The Reach

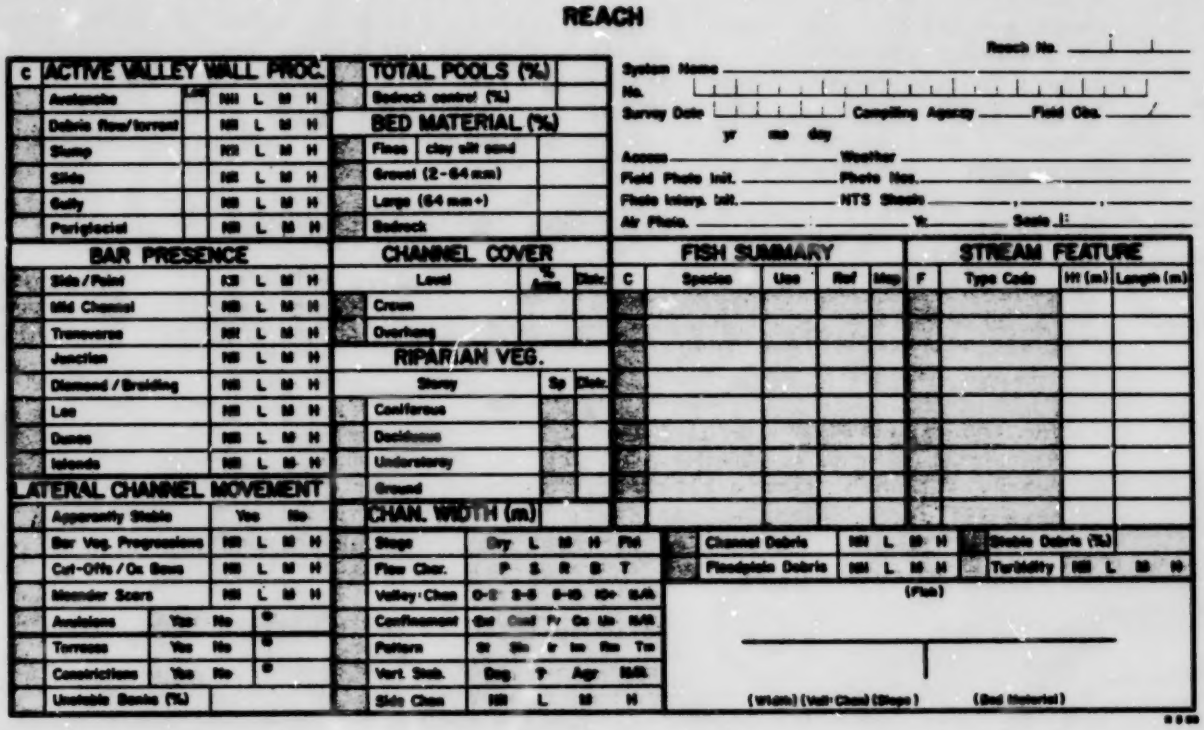
The reach is the primary mapping unit, being somewhat analogous to the terrain polygons or boundaries. A reach is a section or length of stream that has a relatively homogeneous pattern or repetitious sequence of habitat types, physical features and fluvial processes. The reach description represents an averaging of physical and biological parameters (Figure 33). The key features used to separate reach types are channel pattern and valley to channel ratios. The initial reach separation is done on the air photos as part of the pre-typing exercise. At the same time any obvious features such as waterfalls, canyons, etc. are noted for verification in the field.

While only a few reach parameters may be used to identify reach changes or breaks, many of the reach parameters are interrelated. A significant change in one parameter is often characterized by changes in other parameters. For example, an increase in slope will usually increase the velocity, which will result in an increase in the size of the bed material; the combined effect may alter the channel pattern, etc.

It is very common to find a reach break corresponding to a terrain boundary. This will be discussed at greater length in Section 7.6 on the Terrain Aquatics Interrelationships.

Most of the reach descriptions are collected through low level helicopter survey flights. The rivers are traversed at the height of 50-150 feet and at a speed of 60-100 mph depending on the size of the channel, vegetation density, winds and pilot experience. The reach descriptions are recorded on tape and any mapping changes (i.e. additions, deletions or relocation of reach breaks) are noted. Point or ground sites are recorded as well as features such as falls, chutes, log jams, beaver dams, spawning area, etc. An attempt is made to take representative photos of each reach and all relevant features.

There were approximately 500 reaches described over about 200 watersheds. All streams in the study area were not described, but the streams covered provide a good cross-section of stream types and represent most streams having fisheries resources. From a limited number of ground sites where fish sampling was done, species composition and distribution were inferred based on habitat information from the reach descriptions.



C/Cx F/Sp	COMMENTS

Figure 33 Reach Card

7.2.3 The Point

A point is a ground sample site where more detailed descriptions and measurements are taken. The point is best chosen at a location that is representative of the reach characteristics, however, this is not always possible due to limited access in some areas. Ground sites can often be chosen from air photos. Points are chosen in a variety of reach types in order to provide a representative sample of habitat types, fish habitat preferences and to support reach data throughout the study area.

The point data (Figure 34) contains more detailed descriptions and measurements of bed material, bank form and material, fluvial processes, flow measurements, habitat descriptions, temperature, etc. The point information helps support reach descriptions as well as providing more detailed measurements that are not available through air photo interpretation or low level flights.

7.2.4 The Fish Sample

At nearly all point sample sites fish sampling was conducted. The fish card (Figure 35) records species captured, sampling technique(s) used, sampling time, etc. Sampling techniques included electroshocking, beach seining, angling, swim surveys and aerial observations.

Sampling techniques are selected to best sample the habitat or water conditions present. Variability in water depth, velocity and turbidity may render some sampling techniques ineffective while making others more suitable. For example, deep pools are often difficult or impossible to electroshock while angling or swim surveys may prove very effective.

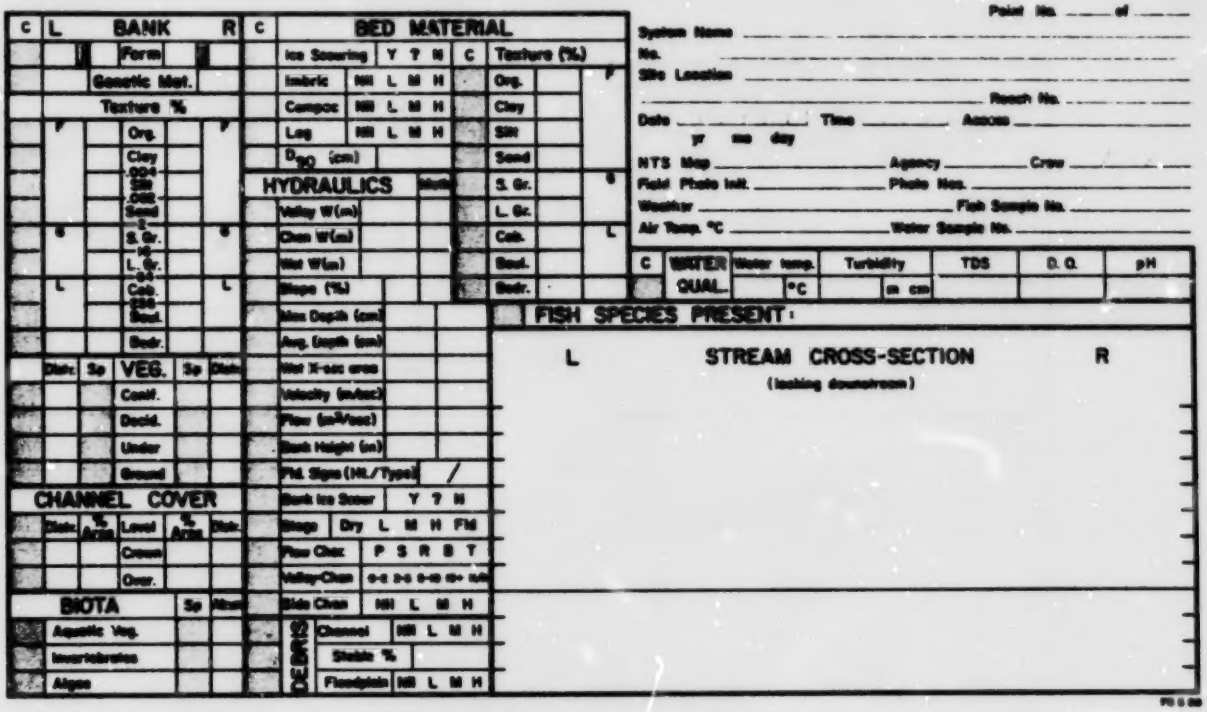
Reconnaissance level inventory does not allow many repeat samples. To help overcome the temporal problem of species utilization, sampling technique selection varied with life stages present or sought. For example, aerial observations of chinook salmon adults were effective in August. For areas sampled earlier in the summer electroshocking for chinook juveniles was effective in establishing the presence or absence of this species.

The main objective of the sampling program was to establish species presence or absence and distribution. Detailed information on life histories, population size or other behavioral aspects of the species encountered was not the purpose of this project. Comments may have been made, however, concerning any of these subjects when observed.

7.3 Lakes

The information and approach to lake inventory is different from that of streams and rivers. The use of helicopters for aerial surveys and the information that can be derived from air photos is greatly reduced. Much of the information (Figure 36) was collected by boat and takes considerably more time than sampling rivers, requiring up to a 24 hour period to complete. As a limited number of lakes could be sampled, a priority list was requested of the Department of Fisheries and Oceans, Whitehorse.

POINT SAMPLE



C/Cx/Sp	COMMENTS

FISH SAMPLE

Fish Sample No. ____
Card ____ of ____

Total No	Species	Method	Size (cm) Min	Size (cm) Max	Fish Use	Sampling: Length (m)	Sampling: Time (s,m,h)	Sampling: Date	DIff.

System Name ____
No. ____
Site Location ____
Point No. ____
Sample Date ____ Time ____ Reach No. ____
yr mo day
NTS Map ____ Access ____ Weather ____
Field Photo Init. ____ Photo Nos. ____
Agency ____ Crew ____

WATER QUALITY	C	Turbidity		C	Horiz. Visibility	
			m cm			m

C / CX	COMMENTS

INDIVIDUAL FISH DATA

Fish No.	Species	Sampling Method	Sex	Maturity	Fork Length (cm)	Weight (gm)	Age	Sample Type & No(s)

Figure 35 Fish Sample Card

The data collection involved some depth soundings, water quality measurements and fish sampling. Time constraints prevented detailed bathymetric mapping, instead a random selection of transects were done from which approximate average depth figures could be derived. Soundings are not available for all lakes sampled however, as equipment problems were encountered part way through the field season.

Water quality measurements consisted of temperature, dissolved oxygen, conductivity and pH measurements taken vertically through the water column. Secchi readings, which measure light penetration in water were also taken.

Fish species composition was determined by using an overnight gill net set. The net consisted of 6-50 foot lengths of varying mesh monofilament gill nets. Mesh size ranged from 1-3½ inch stretched mesh at ½ inch increments. The net was placed perpendicular to the shore usually at a location that provided a sharp decline or drop-off. It was assumed that this approach would maximize the samping of the various depths and corresponding fish species that might be present.

7.4 Mapping and Data Compilation

From the reach, point, fish and lake data, aquatics resources maps have been prepared. These maps display the river reaches with an associated reach summary symbol, fish species distribution, ground site locations, water quality and quantity sites and stream features. All drainage systems with information have the watersheds delineated and identified with unique watershed code numbers.

In addition to single discipline maps and data base, there is an integrated or interdisciplinary component. Aquatics resource information has been added to the terrain unit or polygon description. They are generalized descriptions of the streams and lakes (see Appendix I), derived from air photo interpretation and reach information. The polygon descriptions and maps (based primarily on surficial geology and soils)with the aquatics information has been entered into the interactive graphics system of the Canadian Geographic Information System (CGIS) in Ottawa. Ecodistrict/ecosection maps are to be derived from this base.

More detailed aquatics information in conjunction with geology/soils and vegetation data has also been input to the CGIS (Canada Geographic Information System) program, a component of Canada Land Data System. A subset of the reach file was created by the British Columbia Systems Corporation (BCSC) and has been merged with aquatics maps that have been scribed and input. This provides the capability of data analysis and map production combining aquatics, geology and soils information. A variety of products are anticipated from this process once the data bases are complete.

LAKE CARD

Card No.___ of_____ Ecosection No._____

Lake Name _____ System Name _____ Reach No. ___ Point No._____

No. |_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_| Lat ° ' " Long. ° ' " UTM _____

Date |_|_|_|_|_| Time |_|_|_|_| Access_____ Compiling Agency_____ Crew_____

Weather_____ NTS Sheets_____ , _____ Airphoto No._____ : _____ Yr._____

Field Photo Init._____ Water Sample No._____ Soundings Available yes no , agency_____

Fish Sample Card yes no Air Temp. °C _____

FISH SUMMARY				WATER QUALITY						
C	Species	Use	Ref.	C	Depth(m)	DO(mg/l)	Temp. (°C)	pH	Cond.	

	Secchi Depth (m)		
	% Littoral		
	Lake Size(ha)		
	Lake Shape		
	Lake Perimeter(km)		
	Islands No.		
	% Beaches		
	Max. Depth (m)		
	Av. Depth (m)		
	% Ice Cover		
	Algae	Nil L M H	Sp
	Aquatic Veg.	Nil L M H	Sp
	Inlets No.		Size(m)
	Outlets No.		Size(m)

3/81

c/cx/s	COMMENTS

Figure 36 Lake Card

7.5 Fisheries

The fisheries information of this inventory program was collected at a reconnaissance level. Emphasis was placed on establishing species presence within selected watersheds and extrapolating species distribution based on habitat information derived from reach descriptions. This approach allows large areas to be inventoried in a relatively short time.

In the Southern Lakes study area the following fish species have been recorded:

Chinook salmon	*Oncorhynchus tshawytscha*
Coho salmon	*Oncorhynchus kisutch*
Rainbow trout	*Salmo gairdneri*
Cutthroat trout	*Salmo clarki*
Arctic grayling	*Thymallus arcticus*
Lake trout	*Salvelinus namaycush*
Lake whitefish	*Coregonus clupeaformis*
Broad whitefish	*Coregonus nasus*
Round whitefish	*Prosopium cylindraceum*
Inconnu	*Stenodus leucichthys*
Northern pike	*Esox lucius*
Burbot	*Lota lota*
Longnose sucker	*Catostomus catostomus*
Least cisco	*Coregonus sardinella*
Slimy sculpin	*Cottus cognatus*
Lake chub	*Couesius plumbeus*

In addition to the above species, chum salmon *(Oncorhynchus keta)* have historically returned to spawn within the study area; the Takhini River was one such system (Brown et al., 1976). At present, there are no confirmed Chum salmon runs in any drainage system within the study area.

Coho salmon *(Oncorhynchus kisutch)*, rainbow trout *(Salmo gairdneri)* and cutthroat trout *(Salmo clarki)* are all introduced species. Several lakes have been stocked with one or more of these species for recreational fishing and some experimental pothole fish farming (Brown et al., 1976).

Chinook salmon *(Oncorhynchus tshawytscha)* is presently the only documented anadromous species found in the study area. All other species are strictly freshwater fish.

Fisheries Exploitation

Harvest of the fisheries resource takes place under four categories: commercial, domestic or subsistence, native food, and sport fisheries. Commercial and domestic fisheries are operated on Atlin, Teslin and Bennett Lakes. A native food fishery for salmon is located on the Teslin River below Johnson's Crossing. Native food fisheries for freshwater species are operated on Teslin and Bennett Lakes; a minor fishery exists on Little Atlin Lake.

Target species for commercial and domestic fisheries are lake trout and whitefish. Of the whitefish catch, lake and broad whitefish are the primary species taken, comprising about 95% of the whitefish catch. Round whitefish make up the remainder.

Sport fishing is very popular and important to the Yukon. Sport fishing surveys for 1980 showed sport fishing provided approximately 170,000 man-days of angling for approximately 20,000 resident and visitor anglers. The most significant sport species are arctic grayling and lake trout. It has been estimated that, by total numbers, 50% of the sport catch is arctic grayling, and by weight, 80% is lake trout (Paish, 1981). The most popular sport fishing areas are Tagish, Marsh and Teslin Lakes.

Chinook Salmon

Chinook salmon are found in the Takhini drainage upstream to Kusawa Lake, the Yukon River as far upstream as Tagish, the McClintock-Michie system and the Teslin drainage. The only drainage system that does not contain chinook is the Tagish system, which includes Tagish and Bennett Lakes, Atlin River and all tributaries. It is believed that chinook may spawn in the Tagish River between Marsh and Tagish Lakes but this has not been confirmed (Brown et al., 1976).

Chinook salmon are an important commercial species. Although a commercial fishery does not exist within the study area for this species, chinook that spawn or rear in the study area may be intercepted in the ocean or river fisheries downstream. This species is also taken in the native food fishery within the study area.

Chinook salmon spawn from August to early September. Spawning usually takes place in the mainstem of large rivers. The eggs remain in the gravel over winter, with the fry emerging in the spring. After emerging from the gravel, fry disperse to rearing areas which include the spawning rivers as well as smaller tributary streams. This regular migration of fry into the lower reaches of tributaries during the summer months is an important characteristic of the study area. Pipeline studies also found chinook rearing along the shorelines of lakes (Beak, 1978). Chinook spend from 1-3 years in freshwater (usually 2 years in this area) before migrating to the sea. The most common ocean period is 2-4 years.

Arctic Grayling

Arctic grayling are very common and widespread throughout the entire study area in both rivers and lakes. This species is a very important sport fish; more grayling are captured by angling than any other species in the Yukon. Grayling are not a target species of the commercial or subsistence fishery and are harvested only incidentally.

Grayling are spring spawners, using small streams, large rivers and lakeshores for spawning, which takes place from April to mid-June. Where grayling use small streams for spawning, adults move into streams during break-up, with spawning occurring shortly after. In our study, field work did not begin until

June 1, 1980. It was assumed that most of the spawning had taken place by this time, however some isolated observations of grayling spawning were made in the first weeks of June. Other investigators have noted that after spawning, adults disperse from spawning areas. In some cases, however, they do remain (Beak, 1978).

The eggs usually hatch sometime in June depending on exact spawning time and water temperature. Fry and juveniles will move into the smaller streams to rear over the summer usually after spawning has been completed. Movements to overwintering areas appear to commence near the end of August (Foothills Pipe Lines (Yukon) Ltd., 1978).

Lake Trout

Lake trout are found throughout the study area, tending to inhabit lakes and large rivers. However, lake trout were also found in two smaller tributaries to West Arm of Bennett Lake, Partridge River and Munroe Creek. Lake trout are a very important sport species and a key target species in the commercial and subsistence fisheries.

Spawning occurs in the fall, usually in lakes, however instances of river spawning have been documented (Scott and Crossman, 1973). Spawning usually takes place over large boulder or rubble bottoms. Following spawning the adults disperse (Scott and Crossman, 1973). Hatching usually takes place after 4 to 5 months in late winter to early spring. The fry and juveniles apparently remain along the shores of lakes or rivers for several years (Scott and Crossman, 1973). The only young encountered in our survey were found in Munroe Creek.

Lake Whitefish

Lake whitefish are common throughout the study area in lakes and large rivers. This species is very important to the commercial, subsistence and native food fisheries. They are rarely caught by angling (Scott and Crossman, 1973).

Lake whitefish are fall spawners. In the Beak (1978) studies spawning was observed in pools of clear-water rivers throughout October and along lakeshores in late October. The eggs are randomly dispersed. Hatching takes place in April or May (Scott and Crossman, 1973). The fry congregate along river edges and lake shores.

Broad Whitefish

Broad whitefish are found in lakes and large rivers. This species is not widespread within the study area. The distribution appears to be restricted to Lake Laberge, Yukon River above Lake Laberge to Whitehorse, Teslin River, Teslin Lake, Nisutlin Bay and Nisutlin River. Nisutlin Bay has been identified as an important nursery area for broad whitefish fry and as a migration route for adults that spawn in the Nisutlin River (Foothills Pipe Lines (Yukon) Ltd., 1977, d, e).

This species along with lake whitefish comprise 95% of the whitefish species taken in the commercial, subsistence and native food fisheries (Fast, E., pers. comm.). This is not a sport species.

Spawning has been observed in this species from September to early November (Beak, 1978), usually occurring in rivers; lakeshores and mouths of tributary streams may also be utilized. Following spawning adults migrate to large rivers and lakes to overwinter.

Round Whitefish

Round whitefish are found throughout the study area in lakes and rivers. They are not considered to be of significant economic importance in the Yukon (Beak, 1978). This species may be taken incidentally by sport, subsistence or commercial fisheries, but only comprise an estimated 5% of the whitefish catch (Fast, E., pers. comm.). The reported low numbers taken in the aforementioned fisheries may suggest these fish are selectively excluded due to the mesh size used.

Like the other whitefish, they are fall spawners, spawning occurring from October to November. Lakeshores and pools in clear rivers were identified as spawning areas in the Beak (1978) studies.

Inconnu

Inconnu usually inhabit large rivers and lakes, and have a limited distribution within the study area. This species has only been documented in Lake Laberge, Takhini River, Teslin River, Teslin Lake and Nisutlin Bay.

In the Yukon, inconnu are not considered an important species but are probably taken in small numbers by commercial, subsistence and sport fisheries (Boland, 1973; Eby, 1977).

Spawning occurs in the fall in September and October over gravel substrates in clear streams and rivers. After spawning there is a rapid migration downstream (Fuller, 1955; Alt, 1977). The fry emerge in the spring.

There is a limited distribution and little information about this species in the southern regions of the Yukon.

Northern Pike

Northern pike are found throughout the study area. This species generally inhabits warm, shallow, vegetated areas of lakes and slow-moving rivers (Scott and Crossman, 1973).

In the Yukon, northern pike are not considered an important commercial or subsistence fish although they are probably taken in both these fisheries. They are not considered a great sport fish in the Yukon but still comprises approximately 4.5% of the sport catch according to a 1975 survey (Paish, 1981).

Northern pike are spring spawners. In the spring adults migrate to spawning areas which include rivers, low gradient streams, marshes and along lakeshores (Scott and Crossman, 1973). Spawning occurs immediately after break-up, and hatching approximately two weeks later. Before freeze-up all age-classes move to deeper overwintering areas in lakes and rivers.

Burbot

Burbot is not an important species to the commercial, subsistence or sport fisheries but like many other species, may be taken in all these fisheries incidentally.

Burbot is found throughout most of the study area in lakes, rivers and some small streams. This species was not captured or documented in the southwest portion of the study area, which includes the upper Takhini River, Primrose watershed, Bennett Lake and all its tributaries.

Burbot spawn from January to March, predominantly in lakes, along shores and over shoals; spawning may also occur in streams (Scott and Crossman, 1973).

Non-Mapped Fish Species

The fish in this category are considered non-game or non-commercial species. These species are generally considered to have no direct significance to man, are often very important as forage fish for sport and commercial species. For ease of mapping, this group of fish are all mapped under the symbol OS, referring to "other species". Despite the use of the non-specific symbol for mapping, these species are given the same recognition in the data base as mapped species. When encountered the appropriate species name is used, lengths are recorded, etc. The species included here are: longnose sucker, slimy sculpin, least cisco and lake chub.

Longnose Sucker

This species is of little direct importance except possibly in some areas for domestic dog food, although they may be taken incidentally in the subsistence and commercial fisheries. Longnose suckers are found throughout the study area. They were captured or have been recorded mainly in lakes and larger rivers.

Longnose suckers are spring spawners. They prefer to spawn in streams when available but will spawn in shallow zones of lakes (Scott and Crossman, 1973). Spawning occurs usually in April-May with hatching taking place one to two weeks later depending on temperature (Morrow, 1980).

Least Cisco

The least cisco is found in lakes and rivers. This species is found throughout most of the study area. The only major drainage where they have not been reported, is the Takhini River system. This species is not considered to be

of much importance to commercial, subsistence or sport fisheries. Least cisco are sometimes "jigged" to be used as bait for lake trout fishing (Brown et al., 1976).

Spawning takes place in the fall, probably during October, in lakes and streams over sand or gravel substrate. The adults disperse after spawning (Scott and Crossman, 1973).

Slimy Sculpin

This species is very common and widespread in lakes, rivers and streams throughout the study area. They were captured in most watersheds and were the only species present in many reaches and/or streams. They are a small fish and are of no commercial, subsistence or sports significance.

Sculpins are spring spawners, spawning shortly after ice break-up. Eggs hatch after about 30 days (Morrow, 1980).

Lake Chub

Lake chub has been recorded or is probably present to some extent throughout most drainages within the study area. Only limited number of lake chub were sampled through this program, reflecting low number of individuals and/or a limited effectiveness of sampling techniques used to capture this species. This species has no sport, commercial or subsistence significance.

Lake chub spawn in spring to early summer. Spawning occurs in streams and lakes. Hatching occurs shortly after spawning.

7.6 Aquatics - Terrain Interrelationships

Alluvial material is defined as any material that has been deposited by moving water. Therefore any water course will contain alluvial materials within an alluvial plain. At the reconnaissance level of mapping (1:100,000 scale) the alluvial plains of small streams are not mappable. This applies particularly to steep gradient streams with narrow alluvial floodplains. Therefore an incidental selection of the more important streams (primarily related to size) has occurred through terrain mapping at this scale.

Not all of the larger rivers and streams have been mapped as alluvial units along their entire length; however, this is an exception rather than the rule.

These situations arise where there is no discernable alteration of materials by fluvial processes, except within the immediate channel. Here the floodplain is synonymous with the channel; little or no evidence exists for lateral channel movements. These situations are frequently associated with lacustrine and glaciofluvial units. Some of these mapping units contain the alluvial unit as a subdominate component - for example, an alluvial plain with a lacustrine plain (Lp/Ap). In summary, the more significant water courses within the study area have the valley flats mapped and labelled primarily as alluvial (A) units;

a-few are found as subunits within glaciofluvial or lacustrine units.

Some correlations are observed between the terrain unit and the physical characteristics and processes of the streams and rivers. Large meandering (often tortuously meandering) rivers or river reaches are found within or contained by large lacustrine units. Examples of this are the Takhini River (Plate 47)(Reach 1), and the first reaches of its north tributaries, Thirty-Seven Mile Creek, Little River (Plate 48) and Flat Creek. These units usually contain a high percentage of fines. Water courses found within glaciofluvial or low relief morainal units commonly exhibit either irregular or regular meander patterns. This is demonstrated in the Snafu, Tarfu (Plates 49, 50) and Squanga Creek systems for glaciofluvial deposits and the Nisutlin River, Wolf, Seaforth and Michie Creeks (Plate 51) for morainal deposits. All of these drainage systems discussed so far appear to have high productivity (based on relative catch per unit effort).

Some areas of glaciofluvial deposits also contain numerous irregular-shaped lakes. This is demonstrated by the myriad of lakes found in the Squanga, Seaforth, Snafu (Plate 52) and Tarfu watersheds. These lakes have relatively high productivity and extensive shorelines created by the highly folded and irregular shapes.

In contrast to the other mapped areas, is the southwest sector of the study area. This area includes most of the Tagish drainage and upper Takhini (Plate 53) and Primrose Rivers (Plate 54). Most of the drainage systems flow through combinations of bedrock, colluvial and morainal units. The result is high gradient, large substrate channels, with little or no fish habitat. Straight to irregular channel patterns, with confined, narrow flood or alluvial plains are also characteristic. The Wheaton (Plate 55) and Watson Rivers are exceptions within this region. Their large valleys and often meandering reaches, flow through morainal, glaciofluvial and lacustrine materials. They also appear to be the most productive rivers in the region.

Lakes in this region occupy long deep valleys that have been gouged by ice. These include Tagish (Plate 56), Bennett, Primrose, Takhini and Rose Lakes.

Reach breaks, which indicate changes in the physical characteristics and processes of the river or stream logically reflect the immediate and/or surrounding geology. Terrain units change with variations in drainage conditions and corresponding soil associations, and the inclusion of or changes in secondary or tertiary surficial materials. Correspondingly, approximately 60% of the reach breaks coincide with or are in close proximity to terrain boundaries. The converse is not always true. A single reach may traverse several terrain units. The reach characteristics may vary, however, they may be too subtle or the terrain unit may be too brief to warrant a separate reach, especially at this level of mapping.

Plate 47 Takhini River, Reach 1
Large meandering river within lacustrine unit.

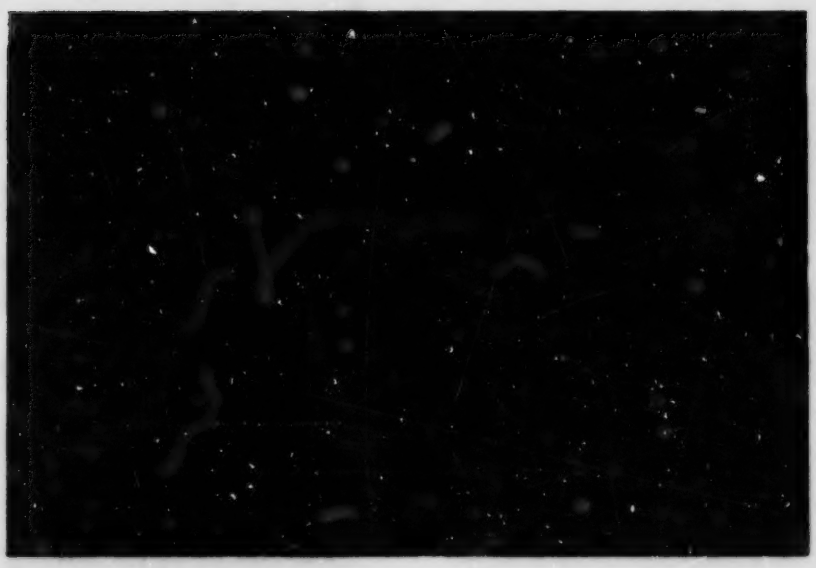


Plate 48 Little River, Reach 1
Meandering river within lacustrine unit.

Plate 49 Tarfu Creek, Reach 1
Irregular meander within glaciofluvial unit.

Plate 50 Tarfu Creek, Reach 2
Irregular patterned creek within glaciofluvial unit.

Plate 51 Michie Creek, Reach 1

Irregular patterned creek within morainal unit.

Plate 52 Snafu Creek, Reach 3

Part of a chain of irregular-shaped lakes within glaciofluvial deposits.

Plate 53 Upper Takhini River, Reach 5

This plate and plate 54 show examples of steeper gradient, large substrate channels that flow through combinations of bedrock, colluvial and morainal units.

Plate 54 Primrose River, Reach 8

Plate 55 Wheaton River, Reach 2

One of the few large meandering rivers in the SW part of the study area.

Plate 56 Tagish Lake

An example of one of the long deep lakes in the region.

8. GLOSSARY

Sources of reference, when used, include the following: Oswald and Senyk (1977), Embleton and King (1971), Walmsley et al. ed. (1980), Whitten (1977), Dumanski ed. (1978), The Canadian System of Soil Classification (1978), Tarnocai (1980).

A: This is a mineral horizon formed at or near the surface in the zone of leaching or eluviation of materials in solution or suspension, or of maximum in situ accumulation of organic matter or both. The accumulation of organic matter is usually expressed morphologically by a darkening of the surface soil (Ah), and conversely the removal of organic matter, iron or clay from the upper part of the solum is usually expressed by a lightening of the soil color and a coarser soil texture (Ae).

Aeolian: see Eolian

Alluvium: Material of any particle size that has been deposited by moving water.

Amorphous: Soil structure term applied to a coherant mass having no regular arrangement of soil particles.

Anadromous: Fish that leave the ocean to ascend freshwater streams and lakes to spawn.

Apron: A relatively gentle slope at the foot of a steeper slope and formed by materials from the steeper, upper slope.

Aquatics: The physical and biological characteristics of watercourses and lakes.

Aspect: Measure of the orientation of a slope by means of compass points: north, south, east or west, or points in between.

Association, soil: A natural grouping of soils based on similarities in climatic and physiographic factors and soil parent materials. It may include a number of soil associates provided that they are all present in significant proportions.

Association complex, soil: A mapping unit used in reconnaissance soil surveys where two or more defined soil units are so intermixed geographically that it is impractical, because of the scale used, to separate them.

B: This is a mineral horizon characterized by enrichment in organic matter (Bh), sesquioxides (Bf), or clay (Bt); or by the development of soil structure (Bn, Bm); or by a change of colour denoting hydrolysis, reduction (Bg), or oxidation (Bm).

Beach Seining: Method of fish capture where one end of a net (usually of small mesh size) is pulled through the water in an arc from the bank to entrap fish within.

Bedrock: The unweathered rock that underlies soil and unconsolidated materials or that is exposed at the surface.

Blanket: A mantle of unconsolidated materials that is thick enough to mask minor irregularities in the underlying unit but still conforms to the general underlying topography. It is usually greater than 1 metre thick.

Bog: Peat covered or peat filled wetland with a high water table, strongly acid groundwater, low nutrient status and usually covered with Sphagnum, feathermosses, ericaceous shrubs and occasional trees.

Bog moss: General term for mosses such as *Aulacomnium* spp., *Drepanocladus* spp., *Tomenthypnum* spp. that are commonly associated with bogs (see also feathermoss, wetland moss).

C: This is a mineral horizon comparatively unaffected by the pedogenic processes operative in A and B (C), except the process of gleying (Cg), and the accumulation of calcium and magnesium carbonates (Cca) and more soluble salts (Cs, Csa). Marl, diatomaceous earth, and rock no harder than 3 on Mohs' scale are considered to be C horizons.

Catena: A nontaxonomic grouping of a sequence of soils of about the same age, derived from similar parent materials, and occurring under similar climatic conditions, but having unlike characteristics because of variations in relief and in drainage.

Cation exchange capacity: The total amount of exchangeable cations that a soil can absorb. It is expressed in milliequivalents per 100 g of soil.

Chernozem: A type of soil with a dark to black surface A horizon 10 cm or more thick; the surface horizon contains up to 17% organic carbon. The mean annual temperature must be higher than or equal to 0°C. These soils usually develop under grassland.

Cirque: A bowl shaped, hollow recess in a mountain resulting from ice erosion.

Clastic rocks: Rocks built up of fragments of pre-existing rocks which have been produced by the process of weathering and erosion, and transported to a point of deposition.

Clay: A particle size fraction less than 0.002 mm in equivalent diameter.

Colluvium: Materials of any particle size that have reached their present position by direct gravity induced movement.

Community (vegetation): A group of plants naturally occurring together, named for dominant overstory species and dominant understory species, i.e. white spruce/feathermoss.

Cretaceous: see geological time-scale.

Cryosol: A soil formed in mineral or organic material that has permafrost within one metre of the surface or within two metres with marked cryoturbation, and a mean annual temperature below 0°C.

Cryoturbation: A collective term to describe all soil movements due to frost action. Encompasses frost heaving and all differential and mass movement including expansion and contraction due to temperature changes.

Debris flow: A form of rapid mass movement involving the downslope movement of saturated fine sediments, rocks, rubble, and vegetative material.

Deglaciation: Uncovering of the land surface brought about by the melting of glacier ice.

Deposit: Material left in a new position by a natural transporting agent such as water, wind, ice or gravity, or by the activity of man.

Drumlin: A smooth, streamline, cigar shaped hill of mainly unconsolidated materials and formed beneath moving glacial ice.

Dunes: Wind built ridges and hills of sand formed in areas of loose unconsolidated surface deposits.

Ecodistrict: A subdivision of an ecoregion characterized by a distinctive pattern of relief, geology, geomorphology, vegetation, soils, water and fauna and usually mapped at a scale between 1:500,000 and 1:250,000.

Ecoregion: An area of land where the vegetation, soils and permafrost reflect the regional climate; usually mapped at a scale between 1:3,000,000 and 1:1,000,000.

Ecotonal: Transition between two vegetation communities.

Electroshocking: Method of fish capture; electric current is passed through the water, stunning fish momentarily.

Eluviation: The process mechanical or chemical by which materials, such as clay, Fe, Al or organic matter, are removed from a horizon in solution or in suspension.

Eolian (Aeolian): Materials transported and deposited by wind action. Generally consist of medium to fine sand and coarse silt.

Ericaceous: A collective term for members of the Ericaceae family; shrubby plants with usually thick leathery leaves, also called heaths.

Erratic: A large pebble, cobble or boulder which has been transported some distance from its source. The term is commonly applied to glacially transported blocks.

Esker: A term applied to long, winding ridges of sand and gravel, unrelated to the surrounding topography, found in previously glaciated regions. They originate within or beneath the ice, either from continuous deposition at

mouth of a subglacial stream as the ice retreated, or from infilling of the tunnels of these streams before recession.

Fan: A fan-shaped form similar to the segment of a cone and possessing a perceptible gradient from the apex to the toe.

Feathermoss: General term for mosses such as *Hylocomium splendens, Pleurozium schreberi, Ptilium Crista-Castrensis* and *Dicranum* spp. These species, occurring over a wide moisture regime, are most common on mesic sites (see also bog moss, wetland moss).

Fen: A peat covered or peat filled wetland with nutrient-rich minerotrophic water at or above the surface. The vegetation consists dominantly of sedges, grasses, reeds and brown mosses with some shrubs and occasional trees.

Fibric: The least decomposed of all organic materials; there is a large amount of well preserved fibre that is readily identifiable as to botanical origin. Fibres retain their character upon rubbing.

Floodplain: The land bordering a stream, built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

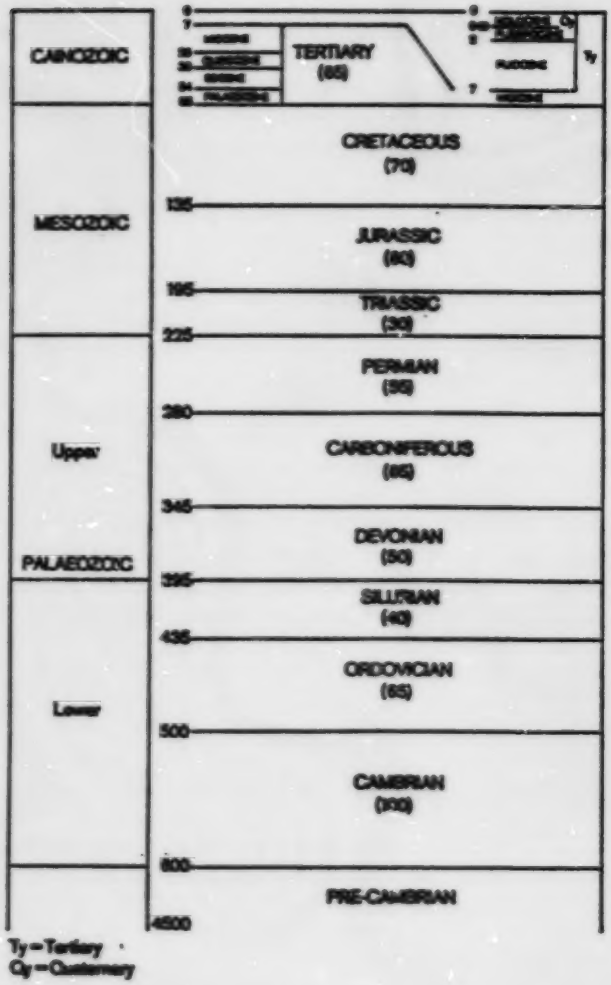
Fluvial deposits: All sediments, past and present, deposited by flowing water including glaciofluvial deposits.

Foliose: A leaflike lichen growth form.

Forbs: A general term used to refer to non-woody plants other than graminoids, mosses and lichens.

Friable: A moisture consistency term pertaining to the ease of crumbling of soils, crushed under gentle to moderate finger pressure.

Geological Time Scale:



The geological time-scale in millions (10^6) of years.

Glaciofluvial: Materials deposited by moving water either directly in front of, or in contact with, glacier ice.

Glaciolacustrine: Material originating from glacier ice and deposited in standing water.

Gleyed (as in soil): Showing evidence of periodic or prolonged saturation with water and reducing conditions such as reduction of iron and other elements, gray colors and mottles.

Graminoid vegetation: A collective term for grasses, sedges, reeds, etc.

Gullied: The modification of a surface by fluvial erosion, resulting in the development of parallel and subparallel, steep-sided, narrow ravines in both consolidated and unconsolidated materials.

Hectare: A metric measurement of surface area equal to 10,000 square metres or 2.471 acres.

Horizon, soil: A layer of soil or soil material approximately parallel to the land surface; it differs from adjacent genetically related layers in properties such as color, structure, texture, consistence, and chemical, biological, and mineralogical composition.

Humus: The fraction of the soil organic matter than remains after most of the added plant and animal residues have decomposed. It is usually dark colored.

Igneous rock: One of the three main groups of rock, often regarded as the primary source of the material comprising the Earth's surface. Formed from molten rock, igneous rocks can be either extrusive, crystalized at the surface; or intrusive, crystallized at depth in the Earth's crust.

Kame: Mounds of poorly sorted, water laid sand and gravel formed within holes or fissures in the glacier or between the glacier and the land surface. (Can also contain other material such as till).

Kettled: Deposit or feature modified by depressions left by melting ice blocks.

Lacustrine deposit: Material deposited in lake water and later exposed either by lowering of the water level or by uplifting of the land. These sediments range in texture from sands to clays.

Landsat imagery: Images converted from magnetic tape records from satellites equipped to sense the earth's resources in four spectral bands, including both visible and invisible wavelengths.

Lichen: An assortment of lichens, usually fruticose, of the genera *Cladina*, *Cladonia*, *Cetraria* and *Stereocaulon*. In alpine areas other genera of common occurrence are *Alectoria*, *Thamnolia* and *Dactylina*. Caribou lichen is a collective term commonly used in reference to species of *Cladina*.

Mesic: Refers to organic material in an intermediate stage of decomposition; neither humic nor fibric. Also used in regard to the ecological moisture regime of a plant species or vegetation community where the term refers to moderately well drained conditions.

Mesozoic: see Geological Time Scale.

Metamorphic: Referring to rocks which have undergone change in composition and texture caused by force, heat, pressure, moisture, etc.

Moraine: Accumulation of material ranging from clay to large block size, that has been transported beneath, beside, on, within and in front of moving ice and deposited on the land surface during both growth and recession of the ice and not modified by any intermediate agent. Lateral moraine - elongate accumulation of rock and soil debris lying on the surface of a glacier in a valley at or near the lateral margin of the glacier. Medial moraine- elongate accumulation of rock and soil debris formed by the joining of adjacent lateral moraines below the junction of two valley glaciers.

Nivation: The process of frost action and mass wasting occurring beneath lingering or perennial snow drifts forming bowl-shaped depressions known as nivation hollows.

Nudum: describes an understory species cover of less than 10%. The remaining cover is bare ground or litter.

Oligotrophic (of lakes): Low productivity in terms of organic matter; nutrient supply low.

Organic matter: The organic fraction of the soil; includes plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by the soil population.

Paleozoic: see Geological Time Scale.

Palsa: A round or elongated hillock or mound, maximum height of about 10 m, composed by a peat layer overlying mineral soil. It has a perennially frozen core which extends from within the covering peat layer downward into or toward the underlying mineral soil.

Parabolic dune: U-shaped or transverse dune with horns pointing upwind.

Parent material: The unconsolidated materials, mineral or organic, from which the solum of a soil has developed by pedogenic processes.

Passerine: Bird of the order Passeriformes, comprising more than half of all birds with feet adapted for perching.

Patterned ground: A general term for any ground surface or surficial soil material exhibiting a discernible more or less ordered and symmetrical, micro-physiographic pattern.

Peat: Unconsolidated, compressible material consisting of partially decomposed, semi-carbonized remains of plants such as mosses, sedges and trees, some animal residues, and commonly some mineral soil.

Peat plateau: A low, generally flat topped expanse of peat, rising one or more metres above the general surface of a peatland. A layer of permafrost exists in the peat plateau, which may extend into the underlying mineral soil.

Permafrost: The thermal condition in soil or rock having temperatures below 0°C persisting over at least two consecutive winters and the intervening summer.

Permeable: Porous, capable of allowing penetration by fluids.

Physiography: The description and interpretation of land forms.

Plasticity: A consistency term referring to the property of changing shape under the influence of an applied stress, and of retaining the new shape after removal of stress.

Platy: Soil structure type referring to particles arranged around a horizontal plane.

Pleistocene: see Geological Time Scale.

Podzol: A type of soil with moderate to strong development whereby organic matter, iron and aluminum are leached from the surface horizon (Ae) and accumulate in the B horizon. These soils usually develop under coniferous trees and on acid parent materials.

Polygon (Southern Lakes Study Area): Primary mapping unit, based on dominant landform and genesis of surficial materials or dominant vegetation community.

Proglacial: Matter carried beyond glacier margins.

Pseudoplaty: Platy structure inherited from the parent material.

Refugium: Area that remained unglaciated during one or more Pleistocene glacial periods.

Regen: Regenerating vegetation which establishes following a disturbance, particularly fire.

Regosol: A type of soil with virtually no horizon development or movement of materials within the soil.

Rock glacier: A glacier-like tongue of angular rock debris usually heading in cirques or other steep walled hollows.

Scarp: A steep slope; abrupt declivity.

Scree: A sheet of coarse rock debris mantling a mountain slope.

Sedimentary rock: Rocks formed from material derived from pre-existing rocks by processes of denudation, together with material of organic origin.

Seral: Any stage in the succession of plants, following disturbances, from pioneers to climax vegetation.

Slump: The contorted structure produced by the movement of a mass of incoherent sediment down a slope.

Solifluction: The process of slow, gravitational, downslope movement of saturated unfrozen earth material behaving apparently as a viscous mass over a frozen surface.

Solum (Sola, plural): The upper horizons of a soil in which the parent material has been modified and in which most plant roots are contained. it usually consists of A and B horizons.

Strata: Layers or levels of any kind, particularly levels in a vegetation community, i.e. height classes.

Stratigraphy: The study of the stratified rocks (sediments and volcanics) especially their sequence in time, the character of the rocks and the correlation of beds in different localities.

String bog (fen): Wetland area marked by serpentine ridges of peat and vegetation interspersed with depressions, many of which contain shallow ponds.

Surficial geology: The study of geological materials at or near the surface.

Tarn: A small lake formed in a cirque.

Till: Unstratified glacial drift deposited directly by the ice and consisting of mainly unsorted clay, silt, sand, gravel, and boulders.

Tortuous meander: The looping and meandering of river channels to such an extent where the direction of flow is often reversed over relatively short distance. Associated with low gradient streams and oxbow lake formation.

Treeline: The elevation above which trees do not occur; tree species may occur, however, in prostrate growth forms.

Tundra: A treeless, generally level to undulating, region of lichens, mosses, sedges, grasses, and some low shrubs, including dwarf willows and birches, which is characteristics of both the Arctic and high alpine regions.

Vegetation zone: Biophysical setting of a vegetation community (see section 3.2.3).

Veneer: Unconsolidated materials too thin to mask the minor irregularities of the underlying surface. A veneer ranges from 10 cm to 1 m in thickness.

Wetland moss: General term for mosses such as *Fontinalis antipyretica, Drepenocladus* spp., *Calliergon* spp. commonly associated with fens (see also feathermoss, bog moss).

Xeric: Refers to a dry ecological moisture regime, typically a result of very rapid drainage.

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10. APPENDICES

APPENDIX A

Weather Stations

A number of weather stations lie in this area and climatological data is good except at higher elevations. In the following listing of stations type PT denotes precipitation and temperature data only. A full program denotes hourly sky cover, present weather, pressure, temperature, dew point, winds, cloud types and amounts and precipitation. The Whitehorse A data also includes rates of rainfall, evaporation, water quality and upper air temperatures, dewpoints and winds.

STATION	LATITUDE	LONGITUDE	ELEVATION METERS	YEARS OF RECORD	TYPE
Annie Lake	60°24'N	134°55'W	777	1976-1981	PT
Carcross	60°11'N	134°34'W	661	Irregular since 1909	PT
Haeckel Hill Tower	60°45'N	135°13'W	1433	1974 onwards summer only	PT
Johnson's Crossing	60°29'N	133°18'W	690	1963 onwards	PT
Takhini River Ranch	60°52'N	135°32'N	756	1980 onwards	PT
Tagish	60°18'N	134°16'W	658	1979 onwards	PT
Tagish Tower	60°16'N	134°11'W	1219	1974 on - summers only	PT
Teslin	60°10'N	132°45'W	701	1943 on	FULL
Whitehorse (A)	60°43'N	135°04'W	694	1942 on	FULL
Whitehorse Riverdale	60°42'N	135°02'W	641	1959 on	PT

APPENDIX B

Wind Velocities and Directions

TESLIN A YUKON

PERIOD JAN 1953 - DEC 1978

DATE	JAN JAN	FEB FEV	MAR MAR	APR AVR	MAY MAI	JUN JUIN	JUL JUIL	AUG AOUT	SEPT SEP	OCT OCT	NOV NOV	DEC DEC	ANNUAL ANNUEL
						PERCENT FREQUENCY							
NNE	2.7	2.6	3.0	2.6	2.1	2.0	2.1	4.0	6.7	7.9	7.4	5.1	4.0
NE	10.1	7.1	6.6	5.5	3.7	3.1	2.9	5.5	9.0	13.0	10.0	15.0	8.5
ENE	10.3	8.3	6.1	3.5	2.6	1.0	1.6	2.5	5.7	11.3	21.2	15.9	7.5
E	11.6	13.5	11.2	6.1	4.3	2.9	2.6	4.1	7.0	13.4	16.4	13.3	8.0
ESE	1.3	2.3	2.7	2.6	2.2	1.6	1.5	2.1	3.1	4.1	2.3	2.1	2.3
SE	1.4	4.2	4.1	5.7	5.4	3.8	3.9	5.0	5.4	6.0	2.7	1.8	4.1
SSE	.9	2.6	3.5	6.2	6.4	6.3	6.2	5.6	5.4	4.5	1.7	1.1	4.2
S	1.6	3.0	6.4	11.0	13.2	14.5	14.0	12.6	9.6	6.7	2.2	1.7	8.2
SSW	.0	1.4	2.0	4.9	7.2	7.1	6.6	5.0	3.7	2.7	1.1	.9	3.7
SW	1.0	3.1	4.5	6.6	9.4	11.4	11.6	9.2	5.2	3.6	1.5	1.1	5.0
WSW	2.2	3.0	4.3	5.6	7.7	10.0	9.5	6.9	4.6	2.1	1.0	1.3	4.9
W	0.0	0.7	9.5	9.6	9.7	11.5	12.3	10.6	7.0	4.5	4.4	7.2	0.7
WNW	3.1	2.1	2.6	2.6	2.2	2.6	3.2	3.2	2.9	2.3	3.1	2.0	2.7
NW	2.3	1.5	1.0	2.0	1.7	1.9	2.3	2.0	1.0	1.5	1.0	1.4	1.0
NNW	.7	.6	.7	.9	1.0	.7	1.0	1.0	1.1	.6	.7	.7	.0
N	2.5	2.5	2.6	2.7	2.5	2.6	2.7	4.0	4.4	4.4	3.4	3.0	3.1
CALM	37.0	32.0	27.6	21.0	10.7	16.1	15.2	16.7	16.6	10.0	10.5	25.6	20.9
						AVERAGE WIND SPEED IN KILOMETRES PER HOUR							
NNE	6.0	7.1	0.2	7.0	7.5	7.0	6.5	5.5	6.5	7.2	7.0	6.5	6.0
NE	6.6	7.5	0.4	7.7	0.5	7.9	6.1	5.9	6.7	7.9	0.1	7.2	7.4
ENE	0.0	9.7	9.6	9.5	9.5	9.5	7.9	6.7	0.2	9.3	10.2	9.1	9.3
E	9.6	11.0	10.0	9.4	9.5	9.1	7.5	7.6	0.3	10.2	11.1	10.4	10.0
ESE	0.6	11.1	11.3	12.0	11.4	10.4	0.2	9.2	10.2	12.9	13.0	12.0	11.1
SE	7.5	10.4	11.2	12.4	12.4	10.9	9.2	9.9	11.0	13.9	13.2	11.9	11.4
SSE	0.0	11.0	10.0	12.6	11.9	11.0	10.0	10.3	12.0	14.9	15.0	13.4	11.9
S	9.7	10.6	9.4	10.9	10.0	9.6	9.0	9.5	11.1	14.3	13.6	12.1	10.6
SSW	9.9	12.0	10.9	13.0	12.6	11.1	10.3	10.1	11.7	15.1	15.5	13.2	11.0
SW	0.5	11.0	10.0	12.7	13.1	12.0	13.1	12.7	12.0	15.9	13.9	9.2	12.7
WSW	9.2	9.6	10.5	12.0	13.4	14.1	13.0	13.0	13.4	15.1	11.0	0.0	12.7
W	9.0	9.7	11.2	12.1	10.0	11.4	10.9	10.0	11.7	12.4	11.0	10.0	11.0
WNW	11.6	11.0	13.3	13.4	9.0	9.0	9.1	9.6	11.6	12.5	12.1	11.7	11.3
NW	0.3	7.4	0.0	9.3	0.7	7.0	0.5	0.4	0.0	9.3	9.0	7.1	0.4
NNW	4.0	4.9	6.2	0.1	7.6	7.2	7.3	6.3	6.1	6.0	5.7	5.4	6.5
N	4.9	5.5	6.1	6.5	6.3	5.4	5.5	5.1	5.4	6.1	6.0	5.2	5.7
ALL	5.3	6.6	7.3	0.7	9.0	9.1	0.7	0.0	0.1	9.6	9.0	6.0	0.0

Wind Velocities and Directions

WHITEHORSE YUKON

PERIOD JAN 1953 - DEC 1978

DATE	JAN JAN	FEB FEV	MAR MAR	APR AVR	MAY MAI	JUN JUIN	JUL JUIL	AUG AOUT	SEPT SEP	OCT OCT	NOV NOV	DEC DEC	ANNUAL ANNUEL
						PERCENT FREQUENCY							
NNE	.3	.2	.6	.8	1.1	1.7	1.8	1.1	.6	.3	.2	.2	.8
NE	.2	.3	.3	.7	1.1	1.6	1.3	.7	.7	.3	.2	.2	.6
ENE	.1	.1	.1	.2	.4	.4	.4	.3	.2	.1	0	.1	.2
E	.5	.7	.5	.9	1.5	2.0	1.6	.9	.7	.5	.4	.6	.9
ESE	.7	1.0	1.6	2.5	3.9	4.2	4.0	2.8	2.0	1.5	.7	.8	2.1
SE	9.9	13.5	14.9	20.2	24.4	23.5	23.6	23.6	22.2	21.1	13.0	12.9	18.6
SSE	15.6	19.0	17.8	18.1	19.9	17.9	18.3	18.6	22.8	25.8	19.5	16.3	19.1
S	13.3	17.4	14.7	15.7	12.3	10.7	11.5	12.3	15.3	17.5	20.7	19.1	15.8
SSW	.8	1.9	2.3	3.8	4.2	3.4	2.9	2.5	2.3	1.9	1.3	1.1	2.4
SW	.6	1.1	2.4	5.2	4.7	4.5	4.0	3.9	2.8	1.7	1.2	.7	2.7
WSW	.3	.5	1.6	2.1	2.3	2.3	1.8	1.8	1.5	.8	.7	.3	1.3
W	1.4	1.7	3.2	3.3	2.7	3.1	3.0	3.2	2.8	2.3	2.5	1.4	2.5
WNW	2.6	2.3	2.3	1.7	1.6	1.4	1.5	1.6	1.4	1.4	2.7	2.2	1.9
NW	15.0	12.1	11.4	6.0	4.3	4.7	4.7	5.2	5.7	6.4	11.1	12.5	8.2
NNW	11.6	9.4	6.7	4.4	3.1	3.3	3.6	4.1	3.0	4.6	9.0	9.9	6.1
N	9.3	6.5	7.3	6.0	4.2	5.7	6.2	6.3	5.3	4.4	5.0	6.0	6.1
CALM	17.0	12.3	12.3	8.4	8.4	9.5	9.0	11.2	10.7	9.4	11.7	15.1	11.4
						AVERAGE WIND SPEED IN KILOMETRES PER HOUR							
NNE	10.5	7.2	12.3	12.6	11.0	9.7	10.3	8.0	8.0	9.5	7.0	6.7	10.1
NE	4.5	5.0	6.3	8.9	8.0	7.9	7.2	6.1	6.3	7.6	5.0	4.3	7.1
ENE	6.9	5.5	9.7	8.3	8.3	8.6	6.6	5.9	4.4	6.7	6.3	6.7	7.2
E	4.9	7.3	10.6	9.2	8.9	9.3	8.7	7.3	6.7	8.5	6.0	4.9	8.1
ESE	10.7	16.2	18.0	16.9	17.0	16.3	16.5	17.1	16.9	19.0	14.9	10.3	16.5
SE	17.1	19.9	19.0	18.6	17.0	16.0	16.7	17.5	18.7	22.0	20.0	21.0	18.7
SSE	23.1	22.0	20.2	18.3	18.2	16.0	15.6	16.9	19.1	21.1	22.4	23.1	19.7
S	20.7	21.9	16.0	15.2	14.5	12.2	11.7	12.7	14.9	17.3	20.5	21.5	17.2
SSW	16.4	18.5	16.1	15.4	16.2	14.0	13.6	13.2	13.4	14.6	14.5	15.4	15.1
SW	10.3	11.2	11.9	12.7	14.0	13.4	12.0	11.4	10.2	9.9	9.5	0.0	12.1
WSW	0.6	10.1	10.9	12.6	14.2	12.3	10.1	9.2	9.6	9.1	7.9	5.0	11.0
W	7.0	7.3	0.7	0.9	10.0	9.0	0.6	7.9	7.4	7.0	7.2	6.4	0.2
WNW	10.6	10.3	9.9	10.6	11.5	10.0	10.4	9.6	9.0	0.0	9.2	9.7	10.0
NW	11.6	11.6	13.6	13.7	12.4	10.0	10.6	10.3	10.3	11.7	11.9	11.5	11.0
NNW	12.9	13.0	14.9	14.5	13.4	12.0	12.3	11.0	13.3	14.1	14.1	13.5	13.5
N	11.2	11.0	13.5	13.0	12.3	10.6	11.1	10.0	10.9	13.4	12.5	12.0	11.9
ALL	13.1	15.4	14.3	14.4	14.4	12.7	12.3	12.6	13.9	16.3	15.5	14.0	14.1

APPENDIX C

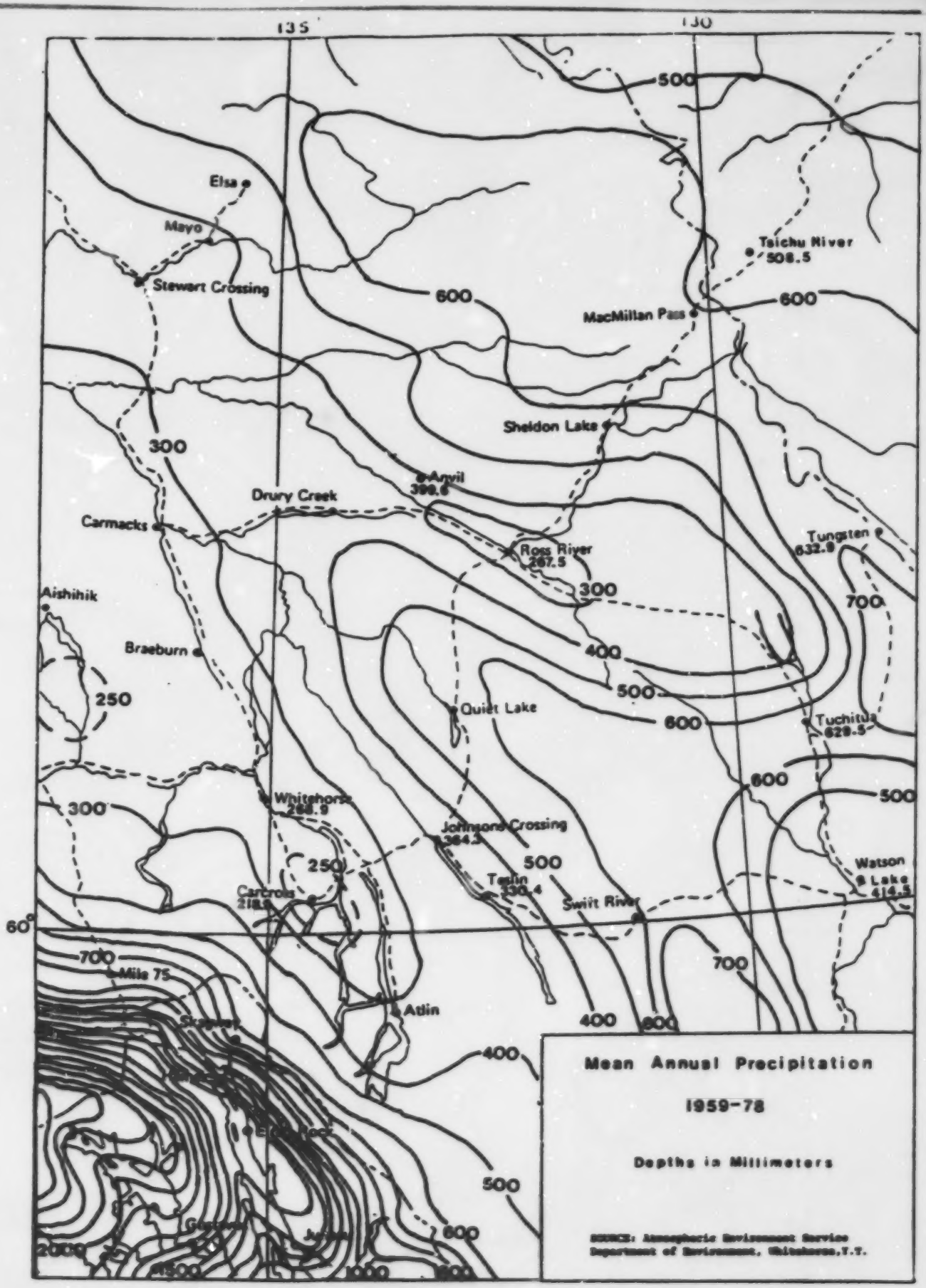
Maps

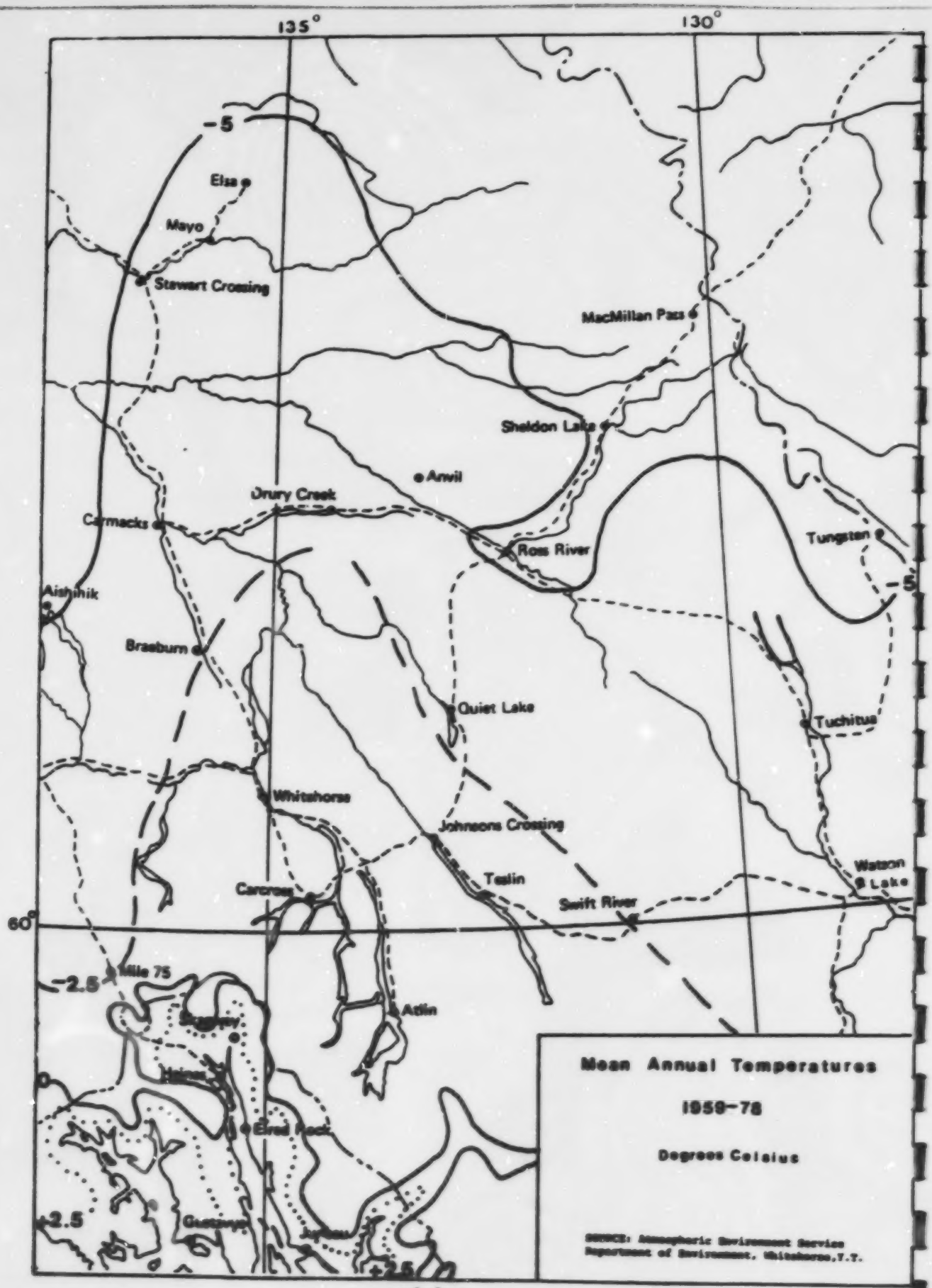
C.1. Mean Annual Precipitation

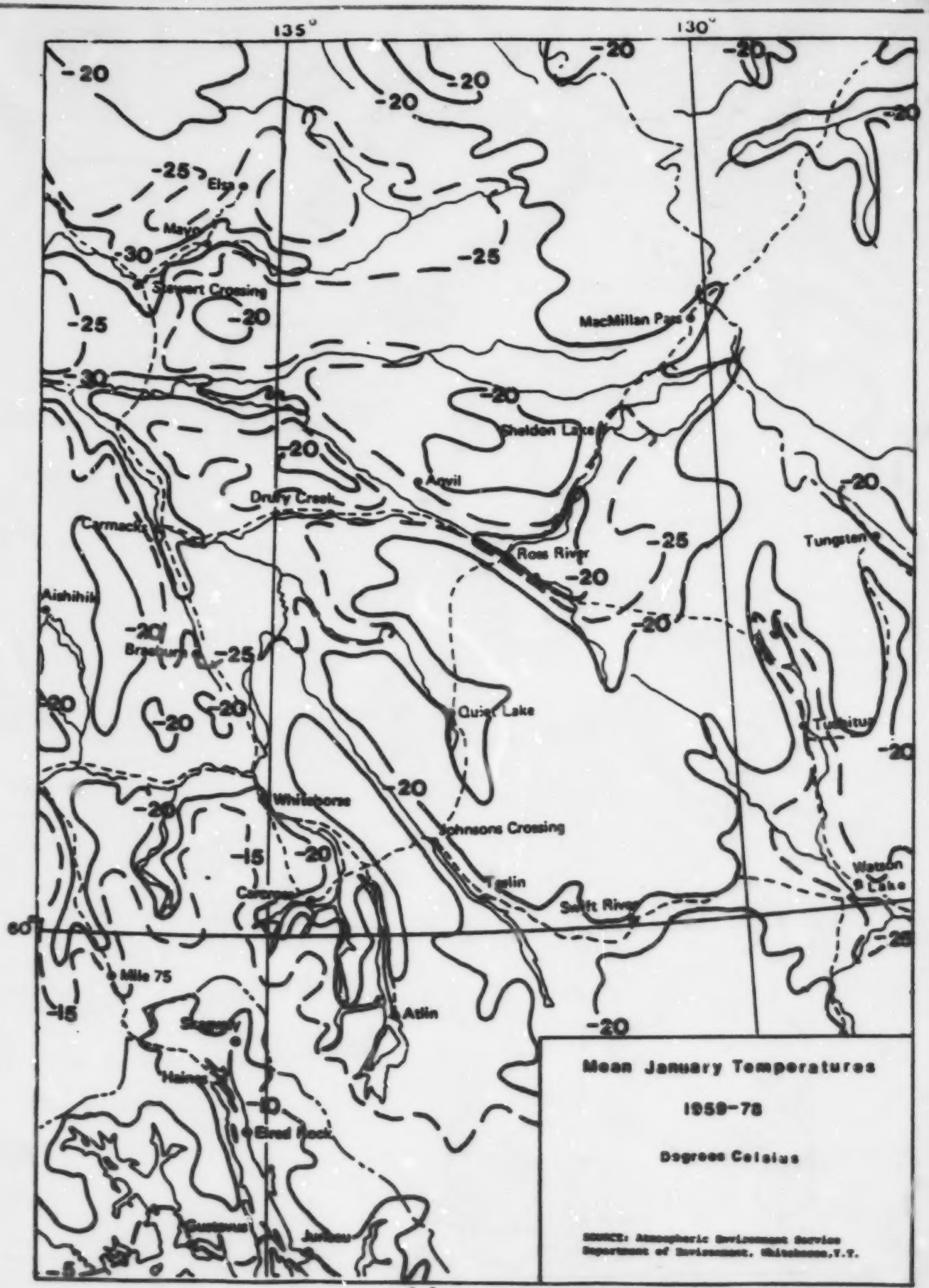
C.2. Mean Annual Temperatures

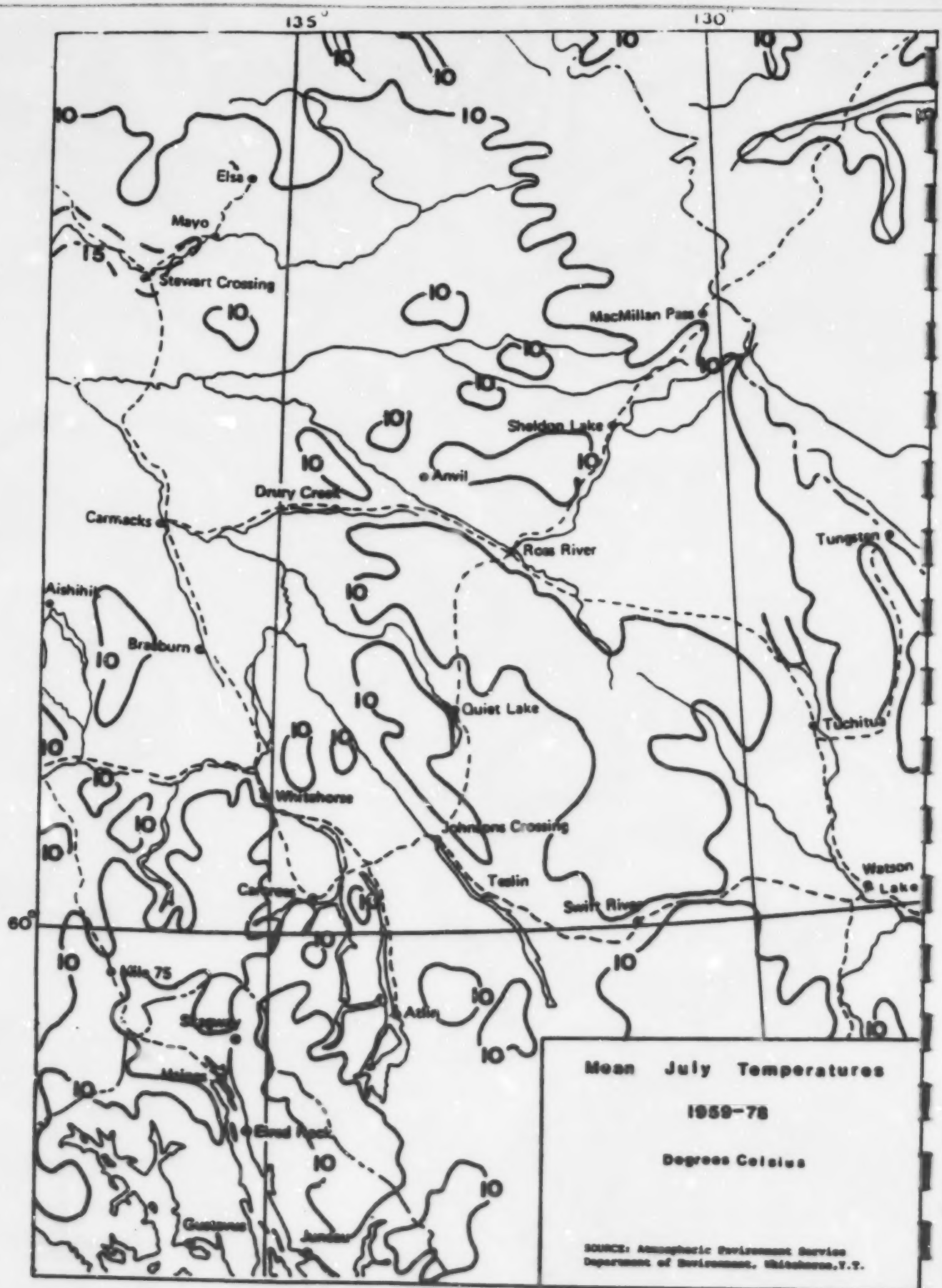
C.3. Mean January Temperatures

C.4. Mean July Temperatures


135
130
60°
Elsa
Mayo
Stewart Crossing
Tsichu River
508.5
MacMillan Pass
Sheldon Lake
Anvil
398.6
Drury Creek
Carmacks
Ross River
267.5
Tungsten
632.8
Aishihik
Braeburn
Quiet Lake
Tuchitua
629.5
Whitehorse
288.9
Johnsons Crossing
384.3
Teslin
330.4
Swift River
Watson
Lake
414.5
Carcross
218.5
Mile 75
Atlin
Mean Annual Precipitation
1959-78
Depths in Millimeters
SOURCE: Atmospheric Environment Service
Department of Environment, Whitehorse, Y.T.


135°
130°
-5
Elsa
Mayo
Stewart Crossing
MacMillan Pass
Sheldon Lake
Anvil
Drury Creek
Carmacks
Ross River
Tungsten
-5
Aishihik
Braeburn
Quiet Lake
Tuchitua
Whitehorse
Johnsons Crossing
Teslin
Watson Lake
Carcross
Swift River
60°
-2.5
Mile 75
Atlin
Haines
Skagway
Klukwan
Gustavus
Juneau
2.5
Mean Annual Temperatures
1959-78
Degrees Celsius
SOURCE: Atmospheric Environment Service
Department of Environment, Whitehorse, Y.T.


135°
130°
60°
-20
-25
-30
-15
-10
-5
Elsa
Mayo
Stewart Crossing
MacMillan Pass
Sheldon Lake
Arvil
Drury Creek
Carmacks
Ross River
Tungsten
Aishihik
Braeburn
Quiet Lake
Tuchitua
Whitehorse
Johnsons Crossing
Teslin
Watson Lake
Swift River
Carcross
Mile 75
Atlin
Haines
Bird Rock
Gustavus
Juneau
Mean January Temperatures
1959-78
Degrees Celsius
SOURCE: Atmospheric Environment Service
Department of Environment, Whitehorse, Y.T.


135°
130°
60°
Elsa
Mayo
Stewart Crossing
MacMillan Pass
Sheldon Lake
Anvil
Drury Creek
Carmacks
Ross River
Tungsten
Aishihik
Braeburn
Quiet Lake
Tuchitua
Whitehorse
Johnsons Crossing
Teslin
Watson Lake
Swift River
Mile 75
Atlin
Mean July Temperatures
1959-78
Degrees Celsius
SOURCE: Atmospheric Environment Service
Department of Environment, Whitehorse, Y.T.

APPENDIX D

Precipitation and Temperatures for Six Stations

D.1.1 Annie Lake - precipitation, temperatures

D.2.1 Carcross - precipitation, temperatures - chart

D.2.2 Carcross - precipitation, temperatures - graph

D.3.1 Teslin - precipitation, temperatures - chart

D.3.2 Teslin - precipitation, temperatures - graph

D.4.1 Johnson's Crossing - precipitation, temperatures - chart

D.5.1 Whitehorse - precipitation, temperatures - chart

D.5.2 Whitehorse - precipitation, temperatures - graph

D.6.1 Whitehorse (Riverdale) - precipitation, temperatures - chart

ANNIE LAKE YUKON LATITUDE 60°24'N LONGTITUDE 134°55'N ELEVATION 771.2m a.s.l.

The Annie Lake site lies in a narrow east-west valley of the Wheaton River. Mountains rise to 1800-2000m to the north, south, and west of the site, sheltering it from the frequent north-south winds common to most other weather sites in the Southern Lakes area. Reduced winds are believed to result in lower minimum temperatures.

1959-1978 calc. Note - Use with caution only 3 to 6 years data

TEMPERATURES	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
Mean Daily Max	-17.8	- 7.0	- 2.6	4.4	10.9	16.4	18.6	17.2	12.1	4.9	- 7.5	-13.8	3.0
Mean Daily Min	-31.4	-24.1	-20.5	- 9.4	- 3.5	- 0.3	2.9	1.1	- 2.3	- 7.1	-18.6	-23.6	-11.4
Mean Daily	-24.6	-15.6	-11.6	- 2.5	3.7	8.1	10.8	9.2	4.9	- 1.1	-13.1	-18.7	- 4.2
Extreme Max	5.6	7.2	11.0	19.0	22.5	28.0	31.0	30.0	19.5	16.5	8.3	6.7	31.0
Date/Year	26/77	19/77	22/79	30/79	29/81	6/80	10/78	20/77	15/80	9/79	13/76	1/76	
Number of Years of Record	5	5	5	5	5	5	5	4	4	5	6	5	
Extreme Min	-48.5	-50.5	-39.5	-28.5	-10.0	- 7.2	- 4.5	- 7.0	-10.5	-15.0	-39.0	-49.5	-50.5
Date/Year	14/80	11/79	3/78	12/81	11/77	24/77	15/78	27/80	12/80	29/78	23/77	9/77	
Number of Years of Record	5	5	5	5	5	5	5	4	4	5	6	5	
PRECIPITATION													
Mean Rainfall	TR	TR	TR	0.2	13.3	28.1	34.2	38.6	22.1	4.4	1.0	TR	141.9
Mean Snowfall	22.2	11.7	13.6	7.8	6.0	2.0	NIL	1.0	5.0	18.0	19.0	22.9	130.2
Mean Total Precipitation	22.2	11.7	13.6	8.0	19.3	30.1	34.2	39.6	27.1	22.4	20.0	23.9	272.1
Number of Days with Measurable Precipitation	11	10	8	6	7	9	12	11	9	10	13	13	119
Mean Month End Depth of Snow on Ground	36	35	25	6	NIL	NIL	NIL	NIL	NIL	5	16	25	

FIGURE D.1.1

CARCROSS YUKON LATITUDE 60°11'N LONGITUDE 134°34'W ELEVATION 661m a.s.l.

1959-1978 calc. TEMPERATURES	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
Mean Daily Max	-15.7	- 7.5	- 2.1	5.4	11.6	18.2	19.6	18.7	12.6	5.2	- 5.6	- 9.8	5.9
Mean Daily Min	-24.4	-18.9	-15.8	- 5.8	- 1.1	3.7	6.4	4.8	1.4	- 3.6	-13.9	-20.3	- 7.2
Mean Daily	-20.1	-13.2	- 8.6	- 0.2	5.3	11.0	13.0	11.8	7.0	0.8	- 9.8	-15.0	-0.7
Extreme Max	8.9	11.1	10.6	20.6	29.4	31.7	31.1	31.0	26.7	16.7	13.3	9.4	31.7
Date/Year	8/26	24/47	/15	29/76	28/47	/36	6/76	19/77	2/38	/36	2/26	/34	
Number of Years of Record	44	44	43	39	42	43	43	42	43	36	34	36	
Extreme Min	-51.1	-48.9	-42.2	-32.8	-12.2	- 6.7	- 3.9	- 6.7	-13.3	-30.0	-40.0	-55.0	-55.0
Date/Year	31/25	1/47	1/19	/20	22/17	3/27	15/38	31/41	29/24	/35	/09	/17	
Number of Years of Record	44	45	43	39	41	42	41	41	43	36	34	35	
PRECIPITATION													
Mean Rainfall	TR	TR	TR	1.0	7.9	19.8	22.9	25.0	19.9	14.6	1.1	1.3	113.5
Mean Snowfall	18.4	16.0	12.1	5.4	0.3	NIL	NIL	TR	2.5	8.2	22.0	20.5	105.4
Mean Total Pcpn	18.4	16.0	12.1	6.4	8.2	19.8	22.9	25.0	22.4	22.8	23.1	21.8	218.9
Number of Days of Measbl Pcpn	6	5	3	2	4	6	8	7	6	6	6	6	65
Mean Month End Depth of Snow on Ground	30	32	13	NIL	NIL	NIL	NIL	NIL	NIL	TR	12	24	
Max Total Pcpn	61.0	157.5	36.8	22.6	35.1	70.2	83.6	72.4	76.2	68.6	70.4	41.1	
Year	24	23	48	20	22	79	10	39	23	13	22	23	
Min Total Pcpn	TR	TR	1.3	NIL	NIL	TR	1.5	4.3	3.8	2.5	4.8	2.5	
YEAR	20	45	73	SVRL	SVRL	24	27	42	73	35	26	22	

FIGURE D.2.1

CARCROSS

Latitude 60° 11'N Longitude 134° 34'W Elevation 661m.a.s.l.

The Carcross site is at the north end of Bennett Lake. Immediately to the south are the Coast Mountians which cause a rain shadow at the site. The generally steep and narrow valleys trend north-south with the exception of the Tagish Valley to the east. Strong south, east, and occasionally north winds are common.

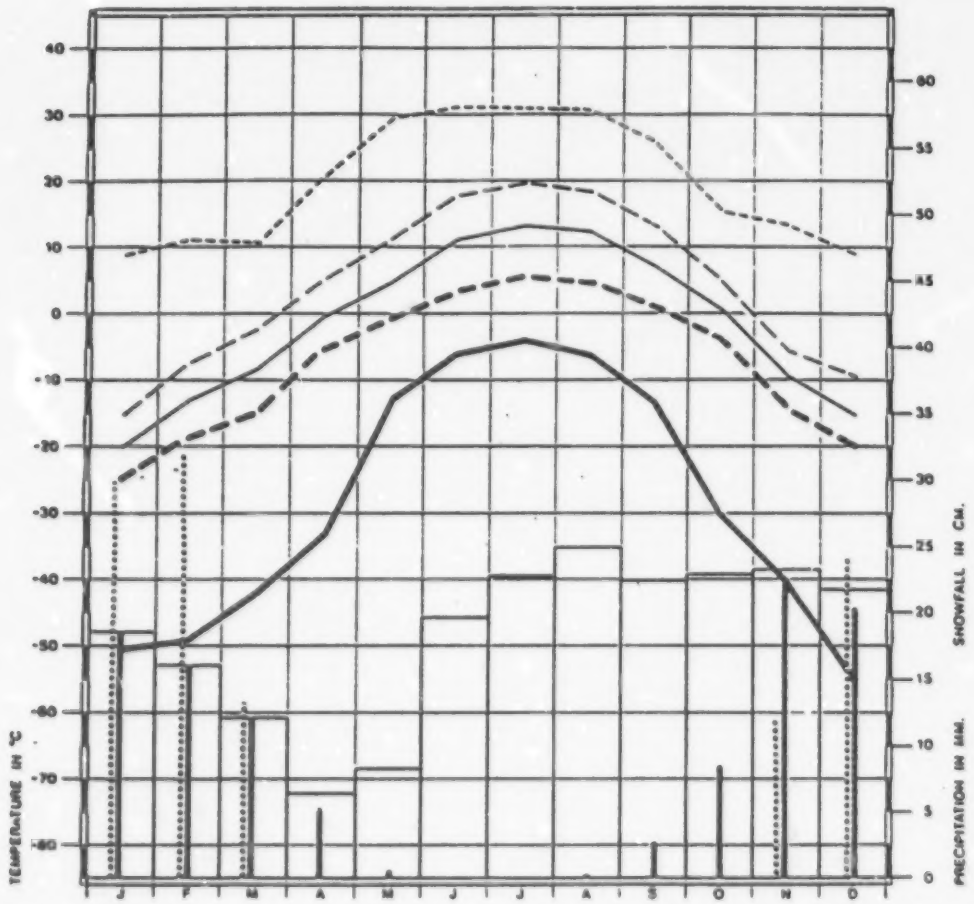


FIGURE D.2.2

TESLIN YUKON LATITUDE 60°10'N LONGTITUDE 132°45'W ELEVATION 701m a.s.l.

1959-1978													
TEMPERATURES	JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
Mean Daily Max	-16.7	- 7.3	- 2.1	5.2	11.9	17.6	19.7	18.0	12.3	4.7	- 6.3	-12.5	3.7
Mean Daily Min	-26.4	-19.0	-14.8	- 6.2	- 0.6	4.1	6.7	5.1	1.2	- 3.7	-14.3	-21.3	- 7.4
Mean Daily	-21.6	-13.2	- 8.4	- 0.4	5.6	10.9	13.8	11.6	6.8	0.5	-10.2	-16.9	- 1.8
Extreme Max	7.8	10.0	10.0	20.0	28.3	33.3	31.1	30.6	26.1	18.3	10.0	7.2	33.3
Date/Year	17/65	27/68	9/65	28/58	28/47	14/69	31/71	1/71	17/67	1/58	4/49	12/44	
Number of Years of Record	36	35	36	36	36	36	36	36	36	37	37	37	
Extreme Min	-52.8	-50.6	-41.1	-27.8	-11.7	- 3.9	- 1.1	- 3.9	-11.1	-22.2	-40.6	-47.2	-52.8
Date/Year	30/47	2/68	3/55	2/72	1/49	21/65	2/45	19/47	24/72	26/56	24/55	24/49	
Number of Years of Record	36	35	36	36	36	36	36	36	36	37	37	37	
PRECIPITATION													
Mean Rainfall	0.5	0.5	0.3	1.6	15.1	27.2	40.3	37.9	37.0	13.5	1.1	0.7	175.7
Mean Snowfall	31.2	21.2	23.9	11.2	2.0	0.2	NIL	TR	1.4	19.5	26.7	30.9	168.2
Mean Total Pcpn	26.3	20.1	23.1	12.3	17.1	27.4	40.3	37.9	38.4	33.0	25.1	29.3	330.3
Number of Days of Measurable Pcpn	12	11	9	7	8	10	12	12	13	12	13	15	134
Mean Month End Depth of Snow on Ground	46	49	41	7	NIL	NIL	NIL	NIL	NIL	3	7	12	
Max Total Pcpn	91.4	50.3	75.9	31.8	38.6	54.4	81.5	66.8	69.9	65.8	60.2	78.5	
Year	52	61	63	47	53	60	50	69	68	74	48	62	
Min Total Pcpn	3.3	4.6	1.5	0.8	1.5	2.0	2.5	4.1	15.5	6.9	4.6	3.8	
Year	50	78	50	55	55	58	71	63	53	48	74	74	

FIGURE D.3.1

TESLIN

Latitude 60° 10'N Longitude 132° 45'W Elevation 701 m.a.s.l.

The Teslin site is at the airport on the northeast shore of Teslin Lake in a broad southeast - northwest valley. Extensive fog and stratus clouds, developing over the lake in early winter, moderate temperatures. The airport,however, remains relatively clear.

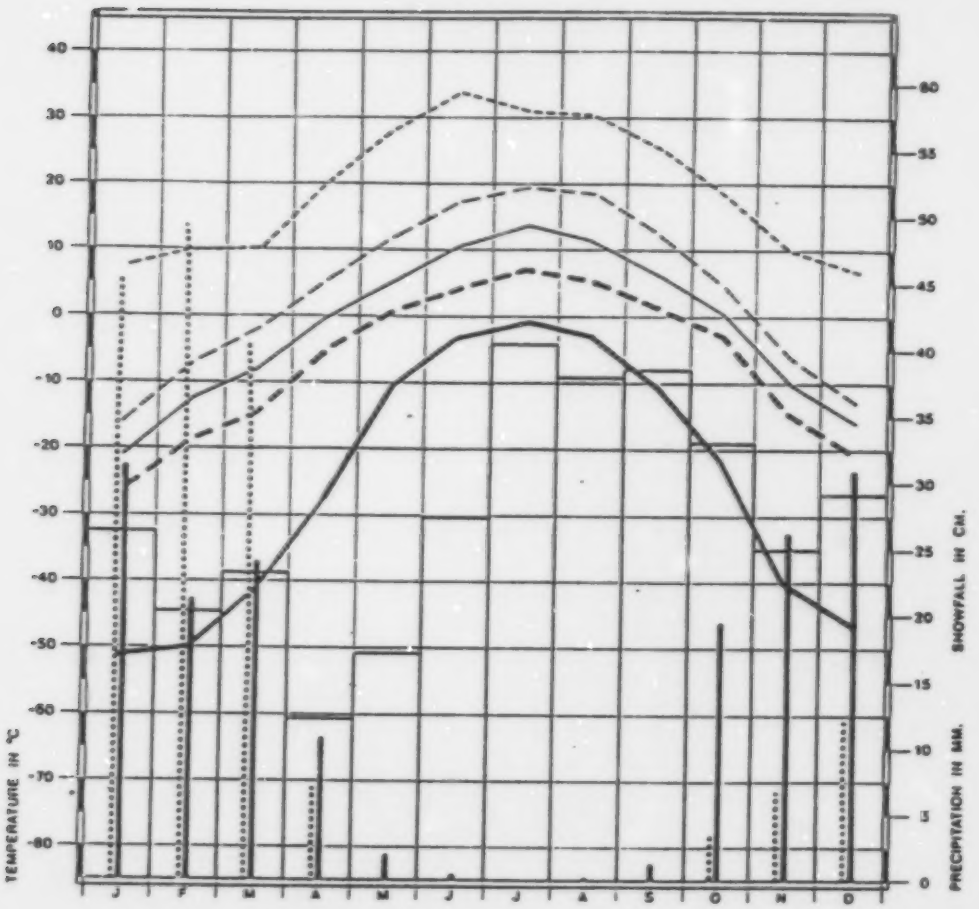


FIGURE D.3.2

JOHNSON'S CROSSING YUKON LATITUDE 60°29'N LONGITUDE 133°18'W ELEVATION 690m a.s.l.

The Johnson's Crossing site is located 6km. below the outlet of Teslin Lake. Upwelling in the lake retards freeze-up of the river well into winter, resulting in considerable fog and low stratus clouds. This site is on a north facing slope which may delay the melting of snow in the spring.

1959-1978 calc.													
TEMPERATURES	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
Mean Daily Max	-17.0	- 8.3	- 1.9	5.7	12.9	19.1	20.1	18.3	12.3	4.6	- 6.9	-12.1	3.9
Mean Daily Min	-26.6	-19.9	-15.5	- 6.9	- 1.3	3.5	5.7	4.6	1.4	- 3.7	-14.6	-21.0	- 7.9
Mean Daily	-21.8	-14.1	- 8.7	- 0.6	5.8	11.2	12.9	11.5	6.8	0.5	-10.8	-16.6	- 2.0
Extreme Max	7.2	12.2	12.8	20.6	24.4	32.2	31.1	30.6	25.6	17.2	8.9	7.2	32.2
Year/Date	16/65	27/68	9/65	29/76	21/68	14/69	17/66	17/77	1/74	7/69	3/74	19/75	
Number of Years of Record	16	15	16	16	15	16	16	15	17	17	17	17	
Extreme Max	-52.2	-51.1	-40.6	-27.5	-11.1	- 3.9	- 2.2	- 2.8	-11.6	-26.7	-38.9	-47.5	-52.2
Date/year	9/75	2/68	8/74	2/79	1/72	21/65	3/74	12/69	26/72	31/75	20/63	11/77	
Number of Years of Record	17	15	16	16	15	16	16	15	17	17	17	17	
PRECIPITATION													
Mean Rainfall	TR	TR	TR	1.2	18.7	27.9	50.4	46.3	44.0	18.0	3.6	TR	210.1
Mean Snowfall	24.2	20.2	17.3	9.6	0.7	NIL	NIL	TR	2.2	16.6	30.2	33.0	154.2
Mean Total Pcpn	24.2	20.2	17.3	10.8	19.4	27.9	50.4	46.3	46.2	34.6	33.8	33.0	364.3
Number of Days of Measl Pcpn	10	9	7	6	7	8	12	12	12	10	13	11	117
Mean Month End Depth of Snow on Ground	51	61	53	7	NIL	NIL	NIL	NIL	NIL	TR	27	43	
Max Pcpn	47.8	43.2	30.7	19.1	54.1	45.2	107.4	71.9	91.7	65.8	55.9	65.8	
Year	76	76	69	71	76	66	69	73	63	74	68	76	
Min Pcpn	5.5	4.5	2.5	TR	5.1	13.0	5.8	14.5	12.7	7.1	13.5	10.2	
Year	78	79	70	74	75	64	79	67	76	69	74	68	

FIGURE D.4.1

WHITEHORSE, YUKON LATITUDE 60°43'N LONGITUDE 135°04'W ELEVATION 694m a.s.l.

1959-1978													
TEMPERATURES	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
Mean Daily Max	-16.5	- 7.3	- 2.5	5.3	12.4	18.1	19.9	18.1	12.3	4.2	- 7.1	-12.0	3.7
Mean Daily Min	-25.2	-17.3	-14.2	- 5.0	0.3	5.5	8.0	6.3	2.5	- 3.0	-14.2	-20.5	- 6.4
Mean Daily	-20.9	-12.3	- 8.4	0.2	6.3	11.8	13.9	12.2	7.4	0.6	-10.6	-16.3	- 1.3
Extreme Max	9.0	11.7	11.7	20.6	30.0	34.6	32.8	30.0	26.7	18.8	11.7	8.3	34.6
Date/Year	26/77	27/68	22/79	29/58	28/47	14/69	9/51	18/77	3/42	1/58	2/70	10/44	
Number of Years of Record	36	36	36	36	37	37	37	37	37	37	37	37	
Extreme Min	-52.2	-51.1	-40.6	-27.8	-11.7	- 2.8	0.0	- 4.4	-11.7	-28.3	-40.6	-47.8	-52.2
Date/Year	31/47	3/68	8/72	2/72	10/64	11/75	2/42	25/48	24/72	31/75	27/48	10/42	
Number of Years of Record	36	36	36	36	37	37	37	37	37	37	37	37	
PRECIPITATION													
Mean Rainfall	TR	TR	TR	0.5	11.7	29.3	34.7	42.0	27.7	5.1	1.0	0.2	152.2
Mean Snowfall	23.4	15.6	17.2	11.3	3.1	1.2	NIL	0.6	4.2	17.7	27.0	24.1	145.8
Mean Total Pcpn	18.3	12.7	13.1	9.7	14.7	30.5	34.7	42.6	31.8	22.3	19.8	18.7	268.9
Number of Days of Measurable Pcpn	12	10	8	6	6	9	12	11	10	10	12	13	119
Mean Month End Depth of Snow on Ground	31	32	22	4	NIL	NIL	NIL	NIL	NIL	3	16	25	
Max Total Pcpn	46.0	37.1	36.3	37.8	38.4	90.9	84.6	103.4	64.5	50.5	51.8	42.4	366.6
Year	1968	1957	1948	1952	1974	1953	1977	1974	1963	1970	1944	1962	1974
Min Total Pcpn	1.6	2.5	1.5	TR	0.8	6.9	5.6	8.9	6.6	1.0	4.3	5.1	170.2
Year	1978	1970	1950	1960	1971	1967	1971	1967	1976	1948	1972	1966 1969	1947

FIGURE D.5.1

WHITEHORSE

Latitude 60° 43'N Longitude 135° 4'W Elevation 694 m.a.s.l.

The Whitehorse site is at the airport on an escarpment 60m above the main part of the city. The Yukon valley, trending north south, narrows here, causing relatively strong winds. North winds produce an up slope circulation. Open water in the large lakes to the south and north cause extensive fog and low cloud in the early winter. Temperature and precipitation data from a valley site are recorded under Whitehorse Riverdale.

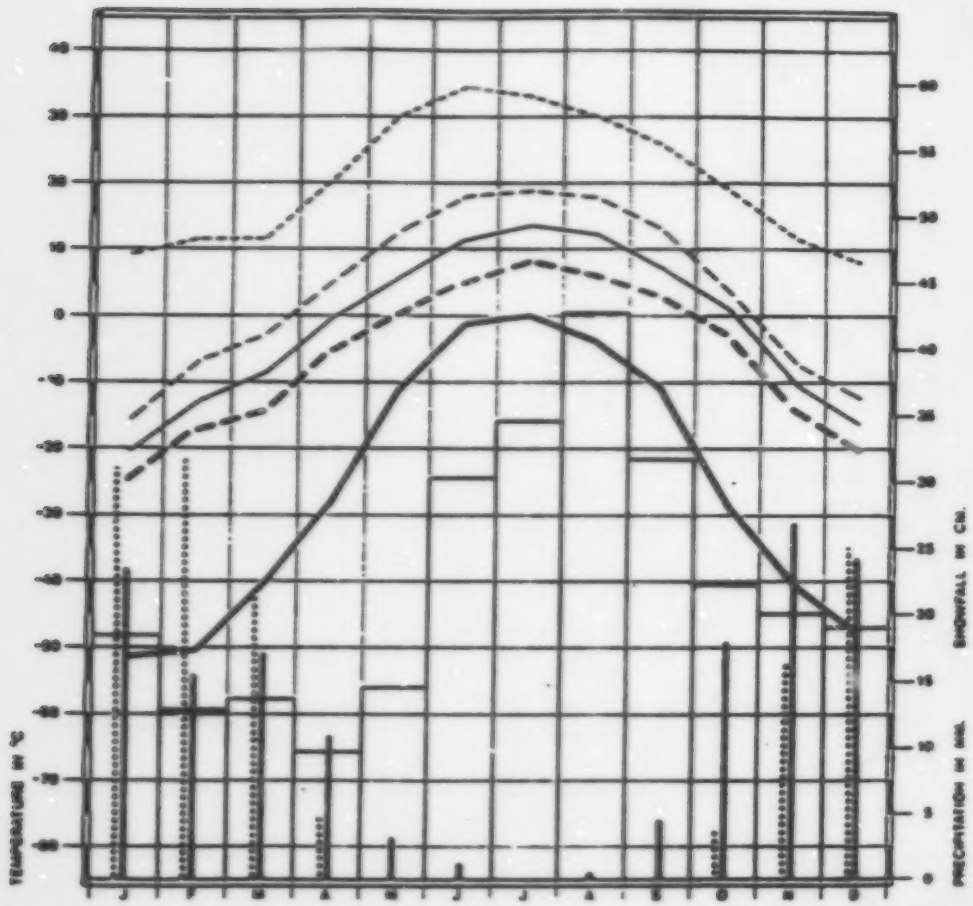

TEMPERATURE IN °C
PRECIPITATION IN MM. SNOWFALL IN CM.
J F M A M J J A S O N D
Extreme maximum temperature
Mean daily maximum temperature
Mean daily temperature
Mean daily minimum temperature
Extreme minimum temperature
Mean snowfall
Mean month end depth of snow of the ground
Mean total precipitation

FIGURE D.5.2

WHITEHORSE (RIVERDALE) YUKON LATITUDE 60°42'N LONGITUDE 135°02'W ELEVATION 641m a.s.l.

The Whitehorse Riverdale site is on the Yukon Valley floor 60m below the airport site. Bowl topography at the Riverdale site results in less wind than at the airport. The lower elevation and reduced air circulation favour more extreme maximum and minimum temperatures than at the airport site.

1969-1978 calc.

TEMPERATURES	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
Mean Daily Max	-16.4	- 6.2	- 0.8	7.1	13.8	19.3	20.9	19.4	13.5	5.3	- 5.8	-12.2	4.8
Mean Daily Min	-26.8	-18.2	-14.7	- 5.6	- 0.6	4.4	7.0	5.5	2.1	- 3.2	-14.0	-21.0	- 7.1
Mean Daily	-21.7	-12.2	- 7.8	0.8	6.6	11.9	14.0	12.5	7.8	1.1	- 9.9	-16.1	- 1.1
Extreme Max	8.3	12.8	12.5	22.8	27.8	35.6	33.3	31.7	26.7	19.4	12.2	6.7	35.6
Date/Year	26/77	27/68	22/79	29/76	22/63	14/69	31/76	19/77	1/74	1/59	2/70	31/61	
Number of Years of Record	21	21	21	21	21	21	20	20	20	21	21	21	
Extreme Min	-48.3	-51.1	-42.8	-31.7	-13.3	- 4.4	- 1.7	- 5.6	-12.2	-28.3	-41.7	-47.8	-51.1
Date/Year	29/66	1/68	8/72	1/63	2/61	1/71	19/63	29/60	29/74	31/75	30/61	12/71	
Number of years of Record	21	21	21	21	21	21	20	20	20	21	21	21	
PRECIPITATION													
Mean Rainfall	TR	1.0	TR	1.0	12.6	34.0	34.2	40.7	25.4	10.0	2.5	0.2	160.7
Mean Snow	21.6	9.8	15.1	11.4	1.0	TR	NIL	NIL	0.7	8.1	19.1	22.1	108.9
Mean Total Ppn	21.6	9.9	15.1	12.4	13.6	34.0	34.2	40.7	26.1	18.1	21.6	22.3	269.6
Number of Days of Meas Ppn	10	9	8	6	6	8	12	12	9	9	11	11	111
Mean Month End Depth of Snow on Ground	25	25	18	TR	NIL	NIL	NIL	NIL	NIL	TR	10	20	
Max Total Ppn	28.4	21.6	26.9	22.9	39.6	50.6	78.1	103.9	51.5	33.0	55.2	32.5	
Year	80	76	79	76	74	77	77	74	77	75	78	76	
Min Total Ppn	1.3	1.5	8.7	TR	3.1	19.8	18.3	11.4	5.9	5.9	2.8	13.6	
Year	78	78	78	79	75	75	78	75	78	79	74	77	

FIGURE D.6.1

APPENDIX E

Soil Orders and Subgroups in the Southern Lakes Study Area

Brunisolic Order

O.MB	Orthic Melanic Brunisol
O.EB	Orthic Eutric Brunisol
E.EB	Eluviated Eutric Brunisol
GL.EB	Gleyed Eutric Brunisol
GLE.EB	Gleyed Eluviated Eutric Brunisol
O.SB	Orthic Sombric Brunisol
O.DYB	Orthic Dystric Brunisol
E.DYB	Eluviated Dystric Brunisol
GL.DYB	Gleyed Dystric Brunisol
GLE.DYB	Gleyed Eluviated Dystric Brunisol

Cryosolic Order

O.TC	Orthic Turbic Cryosol
BR.TC	Brunisolic Turbic Cryosol
R.TC	Regosolic Turbic Cryosol
O.SC	Orthic Static Cryosol
BR.SC	Brunisolic Static Cryosol
R.SC	Regosolic Static Cryosol
ME.OC	Mesic Organic Cryosol
HU.OC	Humic Organic Cryosol
TME.OC	Terric Mesic Organic Cryosol

Gleysolic Order

O.HG	Orthic Humic Gleysol
R.HG	Rego Humic Gleysol
O.G	Orthic Gleysol
R.G	Rego Gleysol
O.LG	Orthic Luvic Gleysol

Luvisolic Order

O.GL	Orthic Gray Luvisol

Organic Order

TY.M	Typic Mesisol
T.M	Terric Mesisol
TFI.M	Terric Fibric Mesisol
TME.M	Terric Mesic Humisol

Podzolic Order

O.HFP	Orthic Humo-Ferric Podzol

Regosolic Order

O.R	Orthic Regosol
CU.R	Cumulic Regosol
GL.R	Gleyed Regosol
GLCU.R	Gleyed Cumulic Regosol
O.HR	Orthic Humic Regosol
GL.HR	Gleyed Humic Regosol

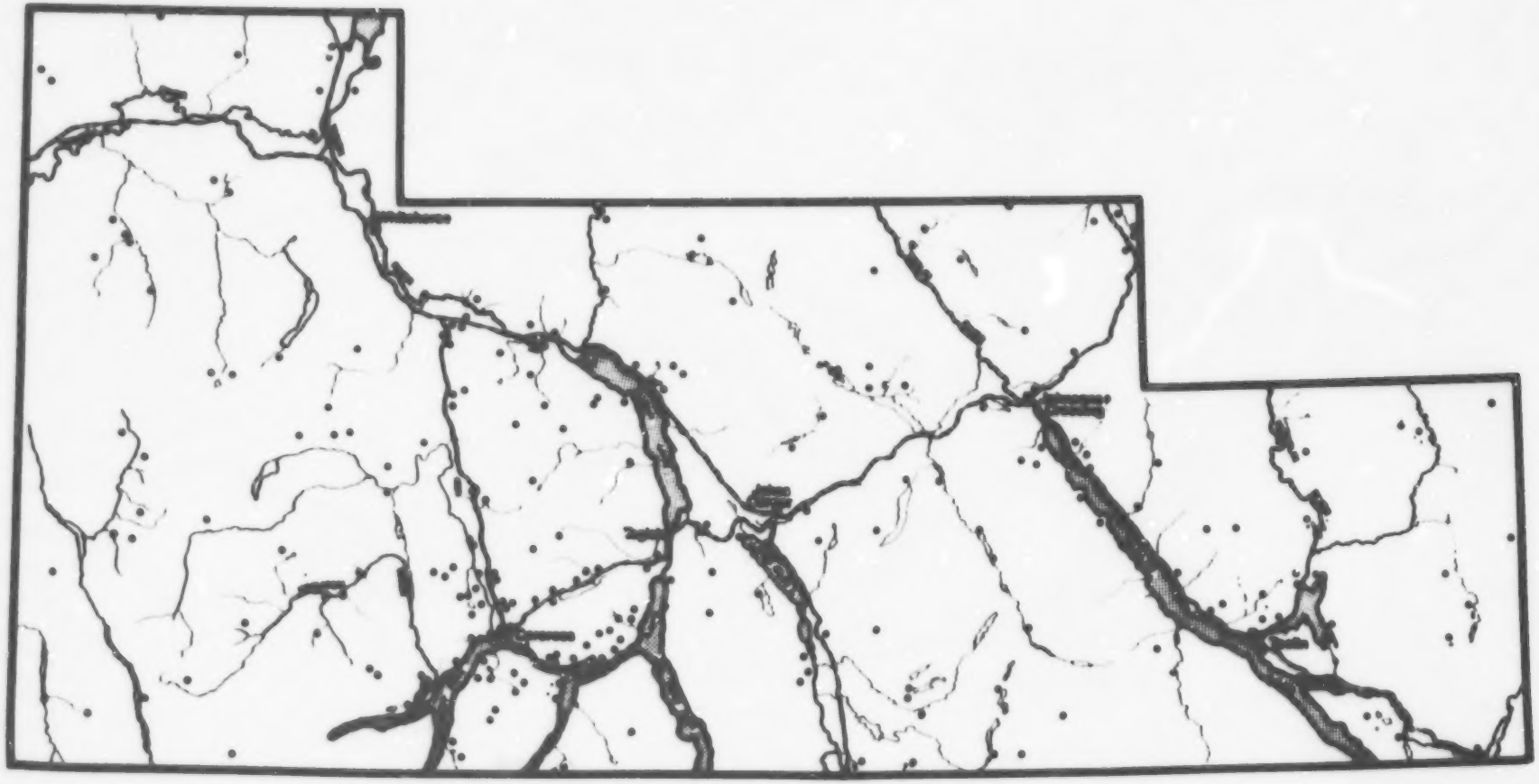
APPENDIX F

F.1 Ground Sites (map)

F.2 Aerial Traverses (map)

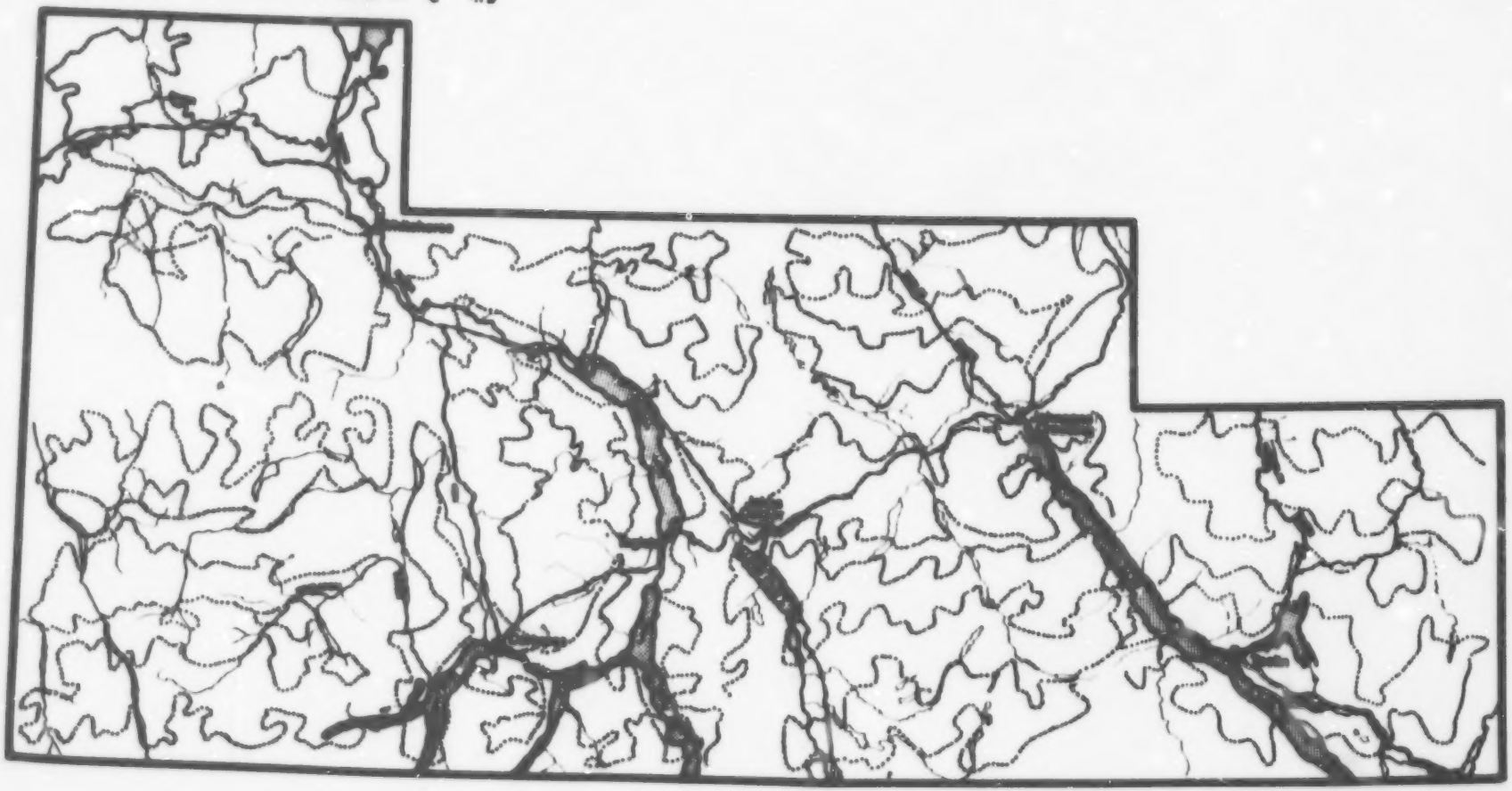
Appendix F

Site Locations (·)



Appendix F

Aerial Traverses (~)



APPENDIX G

Air Photo Flight Lines and Photo Numbers[1]

MAP 105D

Flight Line Number	Photo Numbers
A25265 (1979)	179-189, 202-212, 17-37
A25275 (1979)	22-32, 38-50, 83-95, 96-108
A25192 (1979)	105-125, 160-180, 206-226
A25264 (1979)	168-188, 113-134, 59-78
A25289 (1979)	88-90
A22437 (1971)	88-97, 71-79, 6-15
A25291 (1979)	121-137

MAP 105C

Flight Line Number	Photo Numbers
A25192 (1979)	92-104, 181-192, 193-205
A25265 (1979)	38-54, 152-167, 135-151
A25289 (1979)	67-87, 12-24, 3-11
A22437 (1971)	98-105, 63-70, 16-23
A25264 (1979)	40-51, 152-167
A25288 (1979)	191-194
A25291 (1979)	107-120

[1]Photos may be obtained from National Airphoto Library, D.E.M.R., Ottawa, Ontario.

APPENDIX H

Description and Chemical and Physical Characteristics of Selected Soils[1]

TABLE 1 Orthic Eutric Brunisol - Champagne Association

TABLE 2 Orthic Gray Luvisol - Champagne Association

TABLE 3 Orthic Eutric Brunisol - Morley Bay Complex Association

TABLE 4 Orthic Eutric Brunisol - Sterlin Association

TABLE 5 Orthic Gleysol - Wheaton River Association

TABLE 6 Terric Mesisol - Tenmile Creek Association

TABLE 7 Orthic Regosol - Carcross Association

TABLE 8 Orthic Dystric Brunisol - Judas Creek Association

TABLE 9 Orthic Eutric Brunisol - Brooks Brook Complex Association

TABLE 10 Orthic Eutric Brunisol - Watson River Association

TABLE 11 Orthic Dystric Brunisol - Watson River Association

TABLE 12 Orthic Dystric Brunisol - Caribou Mountain Association

TABLE 13 Orthic Dystric Brunisol - Gray Ridge Complex Association

[1]Methods of analysis follow McKeague (1978).

TABLE 1 Orthic Eutric Brunisol (Champagne Association)

Site 80-090 Vegetation Community: Aspen/Kinnikinnick

HORIZON	DEPTH (cm)	DESCRIPTION
LF	4-0	Litter, semi-decomposed organic matter.
Ah	0-2	Black (10YR2/1, dry); silt loam, weakly granular; friable; slightly plastic; slightly acid.
Bm	2-7	Brown to dark brown (7.5YR4/4, dry); silt loam; weakly granular; friable; slightly plastic; medium acid.
C	7-42	Light brownish gray (10YR6/2, dry), silt loam; massive; slightly plastic; mildly alkaline.

Chemical and Physical Characteristics

Analytical Lab No.	cm Depth	Horizon	pH 1:2 $CaCl_2$	%C	%N	Sodium Pyrophosphate			Exchangeable Cations				Particle Size Distribution (%)								% $CaCO_3$ Equiv.	Elec. Cond. mmhos /cc
						%Fe	%Al	%Mn	Ca	Mg	K	Al	Total Sand	2-1	1-.5	.5-.25	.25-.1	.1-.05	Silt	2u Clay		
80-4029	0-2	Ah	6.2	13.48	0.64	0.15	0.12	0.104	27.0	1.59	2.26	-	24.1	1.1	8.4	1.8	6.0	6.9	61.3	14.6		0.31
80-4029A	2-7	Bm	6.0	1.25	0.06	0.05	0.02	0.032	6.06	0.57	0.25	-	14.5	0.9	0.9	1.7	4.9	6.1	66.8	18.7		0.12
80-4030	7-42	C	7.7	1.88	0.02	0.02	0.0	0.008					11.5	0.8	0.6	1.1	4.5	4.6	76.6	11.9	10.66	0.18

TABLE 2 Orthic Gray Luvisol (Champagne Association)

Site 80-106 Vegetation Community: Pine/Willow-Shrub Birch

HORIZON	DEPTH (cm)	DESCRIPTION
LF	2-0	Black (10YR2/1, moist); semi-decomposed organic matter, many medium roots.
Ahe	0-2	Light gray (2.5Y7/2, moist); clay; amorphous; friable; many medium roots; slightly acid.
AB	2-20	Yellowish brown (10YR5/4, moist); clay; strong, medium, subangular blocky; firm; few medium roots, slightly acid.
Bt	20-36	Yellowish brown (10YR5/4, moist); heavy clay; strong, medium, angular blocky, firm, few fine roots; neutral.
BC	36-65	Olive yellow (2.5Y6/2, moist); silty clay; strong, medium, angular blocky; friable; neutral.
Ck	65-82	Olive yellow (2.5Y6/2, moist); silty clay; strong, medium, pseudoplaty; friable; mildly alkaline.
C	82+	Dark grayish brown (2.5Y4/2, moist); silt loam; strong, medium, pseudoplaty; friable; mildly alkaline.

Chemical and Physical Characteristics

Analytical Lab No.	cm Depth	Horizon	pH 1:2 $CaCl_2$	%C	%N	Sodium Pyrophosphate %Fe	%Al	%Mn	Exchangeable Cations Ca	Mg	K	Al	Particle Size Distribution (%) Total Sand	2-1	1-.5	.5-.25	.25-.1	.1-.05	Silt	2u Clay	% $CaCO_3$ Equiv.	Elec. Cond. mmhos /cc
80-4041	0-2	Ahe	6.4	3.40	0.19	0.16	0.07	0.022	13.25	1.89	1.31	-	21.0	1.1	0.7	1.6	7.7	9.9	35.7	43.4		1.16
-4041A	2-20	AB	6.2	0.91	0.10	0.10	0.06	0.010	5.38	2.36	1.46	-	25.6	0.4	0.7	2.5	10.0	12.0	16.0	58.5		0.89
-4042	20-36	BT	6.9	0.87	0.10	0.07	0.05	0.008					1.8						9.4	88.8		0.27
-4043	36-65	BC	7.2	1.17	0.03	0.02	0.02	0.007					2.6						48.3	49.1	5.72	0.37
-4044	65-84	C	7.5	0.95	0.03	0.02	0.02	0.008					5.3						51.6	43.1	5.23	0.31
-4044A	84	Cca	7.6	0.91	0.02	0.02	0.02	0.008					23.3	0.2	0.2	0.4	12.1	10.5	52.6	24.1	2.74	0.24

TABLE 3 Orthic Eutric Brunisol (Morley Bay Complex)

Site 80-153

Vegetation Community: White Spruce/Feathermoss

HORIZON	DEPTH (cm)	DESCRIPTION
LFH	3-0	Litter, semi-decomposed organic matter, and humus.
Ah	0-2	Very dark brown (10YR2/2, moist); sandy loam; single grained; friable.
Bm	2-15	Yellowish brown (10YR5/4, moist); sandy loam; single grained; friable; contains 10% subrounded gravel by volume, estimated.
BC	15-32	Light olive brown (2.5Y5/4, moist); sandy loam, single grained; 10% subrounded gravel by volume, estimated.
C	32-45	Light yellowish brown (2.5Y6/4, moist); sandy loam; single grained; firm; 20% subrounded gravel by volume, estimated; medium acid.

Chemical and Physical Characteristics

Analytical Lab No.	cm Depth	Horizon	pH 1:2 $CaCl_2$	%C	%N	Sodium Pyrophosphate			Exchangeable Cations				Particle Size Distribution (%)								% $CaCo_3$ Equiv.	Elec. Cond. mmhos/cc
						%Fe	%Al	%Mn	Ca	Mg	K	Al	Total Sand	2-1	1-.5	.5-.25	.25-.1	.1-.05	Silt	2u Clay		
80-4095	32-45	C	5.6	0.32	0.02	0.05	0.03	0.003	6.94	0.62	0.07	-	56.2	5.2	9.3	12.6	18.0	11.2	30.5	13.3		0.05

TABLE 4 Orthic Eutric Brunisol (Sterlin Association)

Site 80-242

Vegetation Community: Pine/Grass

HORIZON	DEPTH (cm)	DESCRIPTION
LFH	4-0	Litter, semi-decomposed organic matter, humus.
Bm	0-10	Dark brown (7.5YR3/4, moist); loam; moderate to strong, medium, granular; firm; abundant, fine and coarse roots, with horizontal orientation and exped distribution.
BC	10-27	Olive brown (2.5Y4/4, moist); loamy sand; single grain; friable; few, fine and coarse roots, with horizontal orientation and matrix distribution; contains 5% rounded gravel by volume, estimated.
C_1	27-38	Light olive brown (2.5Y5/4, moist); sand (medium and coarse); single grain; loose; very few, very fine roots with oblique orientation and matrix distribution; contains 40% subrounded to rounded gravel by volume, estimated.
C_2	38-43	Pale olive (5Y6/3, moist); sandy loam; single grain; friable; few, very fine and fine roots with oblique orientation and matrix distribution; contains 20% subrounded to rounded gravel and cobbles by volume, estimated.
C_3	43-52	(2.5Y5/4, moist); sand (medium and coarse); single grained, loose, very few, very fine roots with oblique orientation and matrix distribution; contains 60% subrounded gravel and cobbles by volume, estimated.

Chemical and Physical Characteristics

Analytical Lab. No.	cm Depth	Horizon	pH 1:2 $CaCl_2$	%C	%N	Sodium Pyrophosphate			Exchangeable Cations				Particle Size Distribution (%)								% $CACO_3$ Equiv.	Elec. Cond. mmhos /cc
						%Fe	%Al	%Mn	Ca	Mg	K	Al	Total Sand	2-1	1-.5	.5-.25	.25-.1	.1-.05	Silt	2u Clay		
80-4444	43-52	C_3	6.4	0.38	0.02	0.05	0.04	0.004	3.24	1.03	0.08	-	84.8	20.2	23.1	13.8	14.6	13.1	9.4	5.8		0.09

TABLE 5 Orthic Gleysol (Wheaton River Association)

Site 80-02

Vegetation Community: Willow >.5 metre/Willow <.5 metre

HORIZON	DEPTH (cm)	DESCRIPTION
LH	4-0	Litter, humus.
Ah	0-4	Very dark brown (10YR2/2, wet); silt loam; massive; friable; neutral.
Bg	4-30	Olive gray (5Y4/2, wet); silt loam; many, medium, distinct mottles; massive; firm; neutral.
Cg	30-52	Olive (5Y4/3, wet); silt loam; massive; firm; neutral.

Chemical and Physical Characteristics

Analytical Lab No.	cm Depth	Horizon	pH 1:2 $CaCl_2$	%C	%N	Sodium Pyrophosphate %Fe	%Al	%Mn	Exchangeable Cations Ca	Mg	K	Al	Particle Size Distribution (%) Total Sand	2-1	1-.5	.5-.25	.25-.1	.1-.05	Silt	2u Clay	% $CaCO_3$ Equiv.	Elec. Cond. mmhos/cc
80-4007	0.4	Ah	6.9	8.68	0.42	0.22	0.04	0.026	23.00	15.58	0.73	-	7.2	0.0	0.0	0.3	2.1	4.8	67.1	25.7		0.36
-4008	4.30	Bg	6.8	0.91	0.03	0.03	0.01	0.012	24.38	3.33	0.36		9.7	0.0	0.5	0.4	0.8	8.1	78.2	12.1		0.39
-4009	30-52	Cg	7.1	0.91	0.03	0.03	0.01	0.011					17.6	0.0	0.6	0.4	0.8	15.8	68.9	13.5	4.95	0.31

TABLE 6 Terric Mesisol (Tenmile Creek Association)

HORIZON	DEPTH (cm)	DESCRIPTION
Om	0-52	Moderately decomposed sedge and moss peat.
C	52	Gravelly, medium to coarse sand.

TABLE 7 Orthic Regosol (Carcross Association)

Site 80-20

(No vegetation sampled at this site)

HORIZON	DEPTH (cm)	DESCRIPTION
LF	2-0	Undecomposed needles and litter; few fine roots.
C	0-100+	Light olive brown (2.5Y5/4 moist); sand; single grained; loose; few fine roots.

Chemical and Physical Characteristics

Analytical Lab. No.	cm Depth	Horizon	pH 1:2 $CaCl_2$	%C	%N	Sodium Pyrophosphate			Exchangeable Cations				Particle Size Distribution (%)								% $CaCO_3$ Equiv	Elec. Cond. mmhos /cc
						%Fe	%Al	%Mn	Ca	Mg	K	Al	Total Sand	2-1	1-.5	.5-.25	.25-.1	.1-.05	Silt	2u Clay		
80-4025	0-20	C	5.3	0.06	0.01	0.01	0.0	0.004	1.06	0.30	0.08	-	93.4	1.3	11.2	13.6	59.1	14.5	0.1	6.5		0.04

TABLE 8 Orthic Dystric Brunisol (Judas Creek Association)

Site 80-183

Vegetation Community: Pine/Willow-Shrub Birch

HORIZON	DEPTH (cm)	DESCRIPTION
LFH	3-0	Litter, semi-decomposed organic matter, humus.
Ah	0-2	Black (10YR2/1, moist); sandy loam; single grain; friable; strongly acid.
Bm	2-18	Dark yellowish brown (10YR3/6, moist); sandy loam; single grain; loose, extremely acid.
C	18-55	Olive brown (2.5Y4/4, moist); loamy sand; loose; very strongly acid.

Chemical and Physical Characteristics

Analytical Lab. No.	cm Depth	Horizon	pH 1:2 $CaCl_2$	%C	%N	Sodium Pyrophosphate			Exchangeable Cations				Particle Size Distribution (%)								% $CaCO_3$ Equiv.	Elec. Cond. mmhos /cc
						%Fe	%Al	%Mn	Ca	Mg	K	Al	Total Sand	2-1	1-.5	.5-.25	.25-.1	.1-.05	Silt	2u Clay		
80-4345	0-2	Ah	5.2	12.12	0.65	0.16	0.14	0.153	28.05	2.82	.55	-	69.5	14.0	16.0	14.4	15.7	9.4	21.9	8.7		0.10
80-4346	2-18	Bm	4.4	0.71	0.10	0.14	0.16	0.001	.35	.14	.04	-	78.1	10.0	16.7	18.7	24.8	8.0	12.4	9.5		0.03
80-4347	18-55	C	4.7	0.20	0.07	0.03	0.07	0.003	.32	.12	.05		79.3	18.5	32.5	19.6	6.7	1.9	18.1	2.6		0.02

TABLE 9 Orthic Eutric Brunisol (Brooks Brook Complex)

Site 80-158

Vegetation Communities: - Aspen/Soapberry-Kinnikinnick
- Pine/Kinnikinnick

HORIZON	DEPTH (cm)	DESCRIPTION
LF	2-0	Litter; semi-decomposed organic matter; abundant medium and coarse roots.
Ah	0-5	Very dark grayish brown (10YR3/2, moist); loam; amorphous; friable; abundant medium to coarse roots; contains 10% subangular gravel by volume, estimated.
Bm	5-20	Dark yellowish brown (10YR4/4, moist); loamy sand; single grain; friable; plentiful medium roots; contains 20% subrounded gravel by volume, estimated.
BC	20-31	Olive brown (2.5Y4.5/4, moist); loamy sand; single grain; friable; few medium roots; contains 40% subrounded gravel and cobbles by volume, estimated.
C	31-52	Grayish brown (2.5Y5/3, moist); loamy sand; single grain; friable; few fine roots; contains 40% subrounded gravel and cobbles by volume, estimated; slightly acid.

Chemical and Physical Characteristics

Analytical Lab No.	cm Depth	Horizon	pH 1:2 $CaCl_2$	%C	%N	Sodium Pyrophosphate			Exchangeable Cations				Particle Size Distribution (%)								$CaCO_3$ Equiv.	Elec. Cond. mmhos/cc
						%Fe	%Al	%Mn	Ca	Mg	K	Al	Total Sand	2-1	1-.5	.5-.25	.25-.1	.1-.05	Silt	2u Clay		
80-4322	31-52	C	6.1	0.23	0.16	0.03	0.01	0.002	2.84	1.22	.05	-	79.9	14.2	18.5	14.4	21.2	11.6	12.5	7.6		0.04

TABLE 10 Orthic Eutric Brunisol (Watson River Association)

Site 80-178 (No vegetation sampled at this site)

HORIZON	DEPTH (cm)	DESCRIPTION
LFH	2-0	Litter, semi-decomposed organic matter and humus, abundant medium and fine roots.
Ah	0-3	Very dark brown (10Y2/2, moist); loam; amorphous; friable; plentiful, medium and fine roots.
Bm	3-14	Dark brown (7.5YR3/4, moist); loam; moderate, medium, granular; friable; plentiful, fine roots; contains 30% subrounded to subangular gravel by volume, estimated.
BC	14-45	Dark yellowish brown (10YR4.5/4, moist); loam; weak, medium, granular; firm; few, fine, roots; contains 60% subrounded to subangular gravel and cobbles by volume, estimated.
C	45-65	Olive gray (5Y5/2, moist); sandy loam; weak, medium, granular; firm, contains 40% subrounded to subangular gravel and cobbles by volume, estimated; slightly acid.

Chemical and Physical Characteristics

Analytical Lab. No.	cm Depth	Horizon	pH 1:2 $CaCl_2$	%C	%N	Sodium Pyrophosphate			Exchangeable Cations				Particle Size Distribution (%)								% $CaCO_3$ Equiv	Elec. Cond. mmhos /cc
						%Fe	%Al	%Mn	Ca	Mg	K	Al	Total Sand	2-1	1-.5	.5-.25	.25-.1	.1-.05	Silt	2u Clay		
80-4341	46-65	C	6.2	1.52	0.08	0.02	-	0.003	11.66	1.60	.05	-	53.6	7.1	10.0	8.7	14.2	13.5	36.5	10.0		0.15

TABLE 11 Orthic Dystric Brunisol (Watson River Association)

Site 80-166

Vegetation Community: - Pine/Willow-Shrub Birch
(Successional community following a fire)

HORIZON	DEPTH (cm)	DESCRIPTION
LF	3-0	Litter; semi-decomposed organic matter.
Ah	0-2	Very dark brown (10YR2/2, moist); loam; single grain.
C(ash)	2-5	White (10YR8/1, moist); loam; weak, fine, granular.
Bm	5-15	Dark yellowish brown (10YR4/4, moist); silt loam; moderate; medium, platy; contains 10% subrounded to subangular gravel by volume, estimated; very strongly acid.
C	15-37	Olive brown (2.5Y4/4, moist); sandy loam; moderate, medium, platy; contains 25% subrounded to subangular gravel by volume, estimated; strongly acid.

Chemical and Physical Characteristics

Analytical Lab No.	cm Depth	Horizon	pH 1:2 $CaCl_2$	%C	%N	Sodium Pyrophosphate %Fe	%Al	%Mn	Exchangeable Cations Ca	Mg	K	Al	Particle Size Distribution (%) Total Sand	2-1	1-.5	.5-.25	.25-.1	.1-.05	Silt	2u Clay	% $CaCO_3$ Equiv.	Elec. Cond. mmhos/cc
80-4327	5-15	Bm	4.8	1.23	0.10	0.23	0.10	0.004	9.36	1.78	.07	-	33.0	2.3	4.6	5.3	9.6	11.2	51.3	15.8		0.06
80-4328	15-37	C	5.1	0.33	0.04	0.07	-	0.001	6.18	1.73	.05	-	56.1	4.3	8.6	9.1	19.8	14.4	29.1	14.8		0.03

TABLE 12 Orthic Dystric Brunisol (Caribou Mountain Association)

Site 80-111

Vegetation Community: - Sedge-Grass/Lichen

HORIZON	DEPTH (cm)	DESCRIPTION
LF	4-0	Litter; semi-decomposed organic matter.
Ah	0-2	Dark yellowish brown (10YR3/4, moist); sandy loam; single grain; friable.
Bm_1	2-11	Dark yellowish (10YR3/6, moist); loamy sand; single grain; friable; contains 15% angular gravel and cobbles by volume, estimate; extremely acid.
Bm_2	11-25	Light olive brown (2.5Y5/5, moist); loamy sand; single grain; friable; contains 10% angular gravel and cobbles by volume, estimate; very strongly acid.
C	25-70	Light olive brown (2.5Y5/4, moist); sand; single grain; friable; contains 10% angular gravel by volume, estimate; very strongly acid.

Chemical and Physical Characteristics

Analytical Lab No.	cm Depth	Horizon	pH 1:2 $CaCl_2$	%C	%N	Sodium Pyrophosphate			Exchangeable Cations				Particle Size Distribution (%)								% $CaCO_3$ Equiv.	Elec. Cond. mmhos/cc
						%Fe	%Al	%Mn	Ca	Mg	K	Al	Total Sand	2-1	1-.5	.5-.25	.25-.1	.1-.05	Silt	2u Clay		
80-4052	2-11	Bm_1	4.3	1.43	0.10	0.14	0.19	0.003	0.51	0.05	0.03	1.08	85.9	21.7	24.4	14.4	16.3	9.2	7.2	6.9		0.05
80-4053	11-25	Bm_2	4.6	0.46	0.03	0.04	0.13	0.003	0.32	0.02	0.04	0.33	84.8	28.4	24.2	12.0	13.8	6.4	9.3	5.9		0.07
80-4054	25-70	C	4.9	0.09	0.01	0.02	0.02	0.002	0.98	0.08	0.07	-	91.5	23.4	26.5	16.1	18.6	6.9	4.1	4.4		0.03

TABLE 13 Orthic Dystric Brunisol (Gray Ridge Complex)

Site 80-188A

Vegetation Community: Ables/Willow-Shrub Birch

HORIZON	DEPTH (cm)	DESCRIPTION
LFH	5-0	Litter, partly decomposed organic matter and humus.
Ah1	0-5	Dark yellowish brown (10YR2/2, moist); loam; amorphous; friable; 20% subrounded gravel by volume, estimate.
C	5-6	Light gray (10YR7/2, moist); loam; amorphous; friable; volcanic ash.
Ah	6-9	Dark yellowish brown (10YR2/2, moist); loam; amorphous; friable; 20% subrounded gravel by volume, estimate.
IIBm	9-32	Dark yellowish brown (10YR3/2, moist); loam; amorphous; friable; 30% subrounded gravel and subangular pebbles by volume, estimate.
IIBC	32-52	Dark yellowish brown (10YR4/3, moist); sandy loam; single-grained; friable; 30% subrounded gravel and subangular cobbles by volume, estimate.
IIC	52-65	Olive brown (2.5Y4/4, moist); sandy loam; single-grained; friable; 30% subrounded gravel by volume, estimate; very strongly acid.

Analytical Lab No.	cm Depth	Horizon	pH 1:2 $CaCl_2$	%C	%N	Sodium Pyrophosphate			Exchangeable Cations				Particle Size Distribution (%)								% $CaCO_3$ Equiv.	Elec. Cond. mmhos /cc
						%Fe	%Al	%Mn	Ca	Mg	K	Al	Total Sand	2-1	1-.5	.5-.25	.25-.1	.1-.05	Silt	2u Clay		
80-4354	52-65	IIC	4.7	0.41	0.10	0.13	0.09	0.004	1.19	.34	.07	-	74.4	8.2	12.7	11.1	21.7	20.7	19.7	5.9		0.02

APPENDIX I

Legend for CGIS data base (watershed & stream reach portion not included)

Variable	Description	
MAPNO	Map Number:	6 alphanumeric characters
POLY#	Polygon No.:	4 numeric characters
ELMAX	Elevation Maximum:	2 numeric characters, no decimals, right justified
ELMIN	Elevation Minimum:	2 numeric characters, no decimals, right justified
ASPEC	Aspect:	2 alphabetic characters (right justified)

Values	Description
N	North
NE	Northeast
E	East
SE	Southeast
S	South
SW	Southwest
W	West
NW	Northwest
NS	North and South
EW	East and West
L	Level
A	All

SLOPE	Slope Class:	1 numeric character

Values	Description
1	0-5% slope
2	6-15% slope
3	16-30% slope
4	31-45% slope
5	46-75% slope
6	75+% slope

Terrain Classification 1

GMAT1	Genetic Material:	1 alphabetic character

Values	Description
A	alluvial
C	colluvial
E	eolian
G	glaciofluvial
L	lacustrine

Variable	Description	
	Values	Description
	M	morainal
	O	organic
	R	bedrock
	I	glacier ice
	Z	water bodies
SEXP1	Surface Expression: 2 alphabetic characters	
	Values	Description
	A	apron
	B	blanket
	D	delta
	F	fan
	H	hummocky
	M	rolling
	P	plain
	R	ridged
	S	steep
	T	terraced
	V	veneer
	X	complex
MODP1	Modifying Process: 1 alphabetic character X 2 possible entries	
	Values	Description
	A	avalanched
	B	bevelled
	C	cryoturbated
	D	deflated
	E	channeled
	F	failing
	H	kettled
	K	thermokarst
	N	nivated
	S	soliflucted
	V	gullied
	W	washed

Terrain Classification 2

GMAT 2	same as GMAT1
SEXP2	same as SEXP1
MODP2	same as MODP1

Terrain Classification 3

GMAT3	same as GMAT1
SEXP3	same as SEXP1
MODP3	same as MODP1

Variable	Description
Soils 1	
SASS1	Soils Association: 2 alphabetic characters, 1 numeric character

Values	Description
CH1	Champagne 1
CH2	Champagne 2
CH3	Champagne 3
CH4	Champagne 4
MB1	Morley Bay 1
MB2	Morley Bay 2
MB3	Morley Bay 3
ST1	Sterlin 1
ST2	Sterlin 2
WT1	Wheaton River 1
WT2	Wheaton River 2
NS1	Nisutlin 1
NS2	Nisutlin 2
TN1	Ten Mile Creek 1
TN2	Ten Mile Creek 2
CS1	Carcross 1
CS2	Carcross 2
JD1	Judas Creek 1
JD2	Judas Creek 2
BB1	Brooks Brook 1
BB2	Brooks Brook 2
BB3	Brooks Brook 3
WS1	Watson River 1
WS2	Watson River 2
WS3	Watson River 3
WS4	Watson River 4
CA1	Caribou Mountain 1
CA2	Caribou Mountain 2
CA3	Caribou Mountain 3
GR1	Gray Ridge 1
GR2	Gray Ridge 2
GR3	Gray Ridge 3
GR4	Gray Ridge 4
R	Rockland

Variable	Description	
DRNG1	Drainage 1:	1 alphabetic character
	Values	Description
	V	very rapid
	R	rapid
	W	well
	M	moderate
	I	imperfect
	P	poor
	X	very poor
	N	not applicable
TEXT1	Texture 1:	2 numeric characters (2 values may be entered)
	Values	Description
	1	silt loam
	2	loam
	3	sandy loam
	4	loamy sand
	5	sand
	7	mesic
	8	not applicable
FRAG1	Fragments 1:	1 alphabetic character
	Values	Description
	G	gravel
	C	cobbles
	S	stones
	N	none
PFST1	Permafrost 1:	1 alphabetic character
	Values	Description
	D	dominant
	S	significant
	N	not applicable

Soils 2*

SASS2	Soil Association 2:	2 alphabetic characters, 1 numeric
	Values	
	same as SASS1	
DRNG 2	Drainage 2:	1 alphabetic character
	Values	
	same as DRNG1	

Variable	Description	
TEXT2	Texture 2:	2 numeric characters (2 values may be entered)
	Values	
	same as TEXT1	
FRAG2	Fragments 2:	1 alphabetic character
	Values	
	same as FRAG 1	
PFST2	Permafrost 2:	alphabetic character
	Values	
	same as PFST 1	

Soils 3°

SASS3	Soils Association 3:	2 alphabetic characters, 1 numeric
	Values	
	same as SASS1	

Streams

DRDEN	Drainage Density:	1 numeric character, use category number

Values	Description
0	non observed
1	few channels 0-3 m
2	several channels 0-3 m
3	many channels 0-3 m
4	few creeks 3-10 m
5	several creeks 3-10 m
6	one river 10-20 m
7	more than one river 10-20 m
8	one large river 20 m+
9	more than one river 20 m+

CHNPT	Channel Pattern:	2 alphabetic characters

Values	Description
ST	straight
SN	sinuous
IR	irregular
MN	meander
TM	tortuous meander
AN	anastomising
BR	braiding
NA	N/A

Variable	Description	
Lakes		
COVER	% Cover:	1 numeric character
	Values	**Description**
	0	none
	1	trace (less than 1%)
	2	1-10%
	3	10-40%
	4	40-80%
	5	80-99%
	6	Lake
NUMBR	Number:	3 numeric characters
MAXSZ	Maximum Size (ha):	1 numeric character
	Values	**Description**
	0	0
	1	0-5
	2	5-10
	3	10-20
	4	20-50
	5	50-100
	6	100-250
	7	250-500
	8	greater than 500
SHAPE	Lake Shape:	2 alphabetic characters
	Values	**Description**
	RN	round
	OV	ovoid
	SQ	squared
	RC	rectangular
	EL	elongate
	IR	irregular
	DN	dendritic
	AR	arcuate
	ML	multiple
	NA	N/A
Vegetation		
ZONEX	Vegetation Zone:	1 numeric character
	Values	**Description**
	1	Alpine
	3	Subalpine
	6	Boreal

Variable	Description

WOOSH — Vegetation - Species Wooded/Shrubs: maximum 6 alphabetic characters

	Values	Description
(Wooded)		
	SW	White Spruce
	SB	Black Spruce
	PL	Lodgepole Pine
	FA	Alpine Fir
	PT	Aspen
	PB	Balsam Poplar
(Shrubs)		
	W	Willow
	BT	Shrub Birch
	LG	Labrador Tea
	SC	Soapberry
	AL	Alder
	VE	Highbush Cranberry

GRSPP — Vegetation - Species Forbs/Graminoids/Non Vascular: maximum 8 alphabetic characters

	Values	Description
(Forbs)		
	D	Dryas
	KI	Kinnikinnick
	EQ	Equisetum
	LB	Twinflower
	EN	Mossberry
	SG	Sage
(Graminoids)		
	G	Grass
	S	Sedge
(Non-Vascular)		
	LI	Lichen
	SP	Sphagnum
	FM	Feathermoss
	BM	Bog moss
	WM	Wetland moss

NOVEG — Vegetation - Non-Vegetated: 2 alphabetic characters

Values	Description
NV	non-vegetated
ND	nudum
AG	agricultural
PA	populated area

STABL — Vegetation - Stability : 1 alphabetic character

Values	Description
B	burn in an early stage

Variable	Description
TRSPP	Vegetation - Tree Type 2 alphabetic characters

Values	Description
P	Pine
H	Hardwood: Aspen
	Balsam Poplar
	Paper Birch
	Softwood: White Spruce
	Black Spruce
	Alpine Fir

TRHGT — Vegetation - Tree Height of Dominant Tree Type: 1 numeric character

Values	Description
1	0.0 m - 7.5 m
2	7.6 m - 17.5 m
3	17.6 m - 27.5 m
4	27.6 m

TRDEN — Vegetation - Tree Density Class of all Tree Types (% crown closure): 1 numeric character

Values	Description
0	0-5%
1	5-15%
2	15-25%
3	25-35%
4	35-45%
5	45-55%
6	55-65%
7	65-75%
8	75-85%
9	85-95%
10	95-100%

Capability Classification

AGRI1 — Agricultural Capability Class 1: 1 numeric character, a maximum of 2 alphabetic characters

Values (numeric characters)	Description
5	suitable for seeded forage
6	suitable for native forage
7	not suitable
8	unclassified

Values (alphabetic characters)	Description
C	climate
W	excess water
R	bedrock
N	salinity
M	droughtiness
E	erosion

Variable	Description

COMT1 — Suitability Class for Construction Materials 1: 1 numeric character 2 alphabetic character

Values (numeric characters)	Description
1	good - fairly good
2	fair
3	poor - unsuitable
8	unclassified

Values (alphabetic characters)	Description
M	material
D	drainage
P	permafrost
R	rock
H	hazards
T	topography

CAMP1 — Suitability Class for Campgrounds 1: 1 numeric character, maximum 2 alphabetic characters

Values (numeric characters)	Description
1	good - fairly good
2	fair
3	poor - unsuitable
8	unclassified

Values (alphabetic characters)	Description
M	material
D	poor drainage
P	permafrost
T	topography
H	hazards
A	aspect
C	vegetation community
Z	vegetation growth

FORT1 — Capability Class for Commercial Forestry 1: 1 numeric character, maximum of 2 alphabetic characters

Values (numeric characters)	Description
1	very good
2	good
3	fair
4	unproductive
8	unclassified

Variable	Description

FORT1 cont'd.

Values	(alphabetic characters)	Description
M		material
W		drainage
P		permafrost
N		salinity

AGRI2 — Agricultural Capability Class 2: 1 numeric character, a maximum of 2 alphabetic characters

Values

same as AGRI1

COMT2 — Suitability Class for Construction Materials: 1 numeric character, a maximum of 2 alphabetic characters

Values

same as COMT1

CAMP2 — Suitability Class for Campgrounds 2: 1 numeric character, a maximum of 2 alphabetic characters

Values

same as CAMP1

FORT2 — Capability Class for Commercial Forestry of SASS2: 1 numeric character, a maximum of 2 alphabetic characters

Values

same as FORT1

APPENDIX J

Caribou Habitat Study

For several years prior to 1980, the Yukon Wildlife Branch monitored the movements of the Lorne/Caribou Mountain and Squanga/Mitchie caribou herds by means of radio-collared animals. The caribou habitat study was initiated in the summer of 1980 to map the vegetation in the area (portions of 105D•NE, 105D•SE, 105C•NW) and investigate possible correlations between caribou movement and vegetation communities.[1]

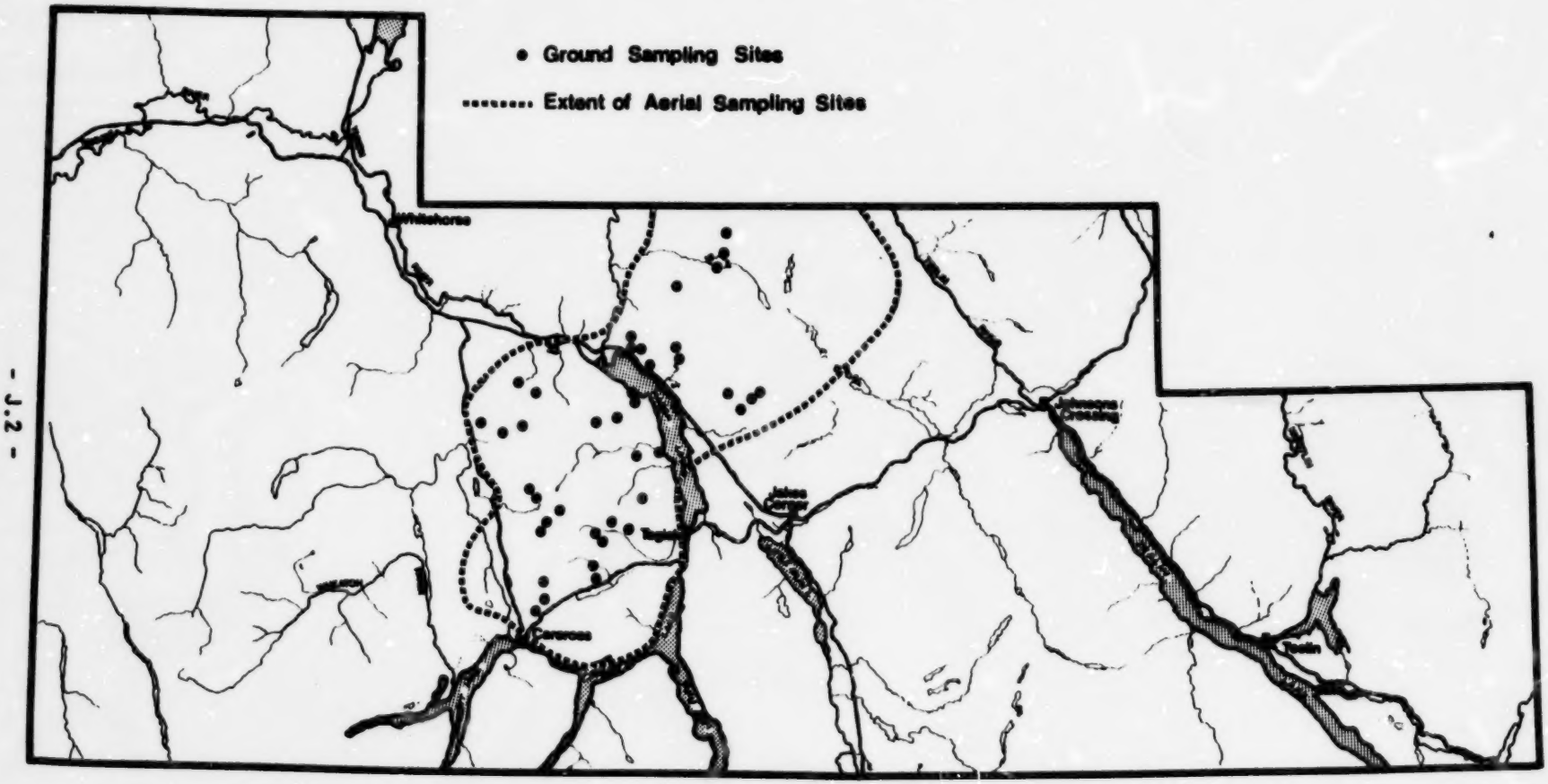
Landsat images (bands 4, 5, 7, scale 1:100,000) served as the basis for mapping. Using unsupervised classification, each image was broken into eight major vegetation "themes".

Aerial site descriptions were completed at 10 to 15 locations within each vegetation theme in order to determine the vegetation community or communities which were most representative of each. Percent cover of the dominant species, physiognomic type and ecological moisture regime were recorded as a helicopter hovered over the sites.

Detailed ground sampling was carried out at several of the most typical locations within each theme, for a total or 33 sites. A circular plot measuring 20 feet in diameter was subjectively chosen at each site. Data was collected in a format similar to the ELS data and was incorporated into the Southern Lakes Resource Inventory data base. Separate vegetation maps were not produced.

[1] Location map, page J.2

Caribou Habitat Study (Summer 1980)



APPENDIX K

Frequency Distribution of Vegetation Sampling Sites by Vegetation Community

DESIGNATOR	VEGETATION COMMUNITY	FREQUENCY OF SITES
D/G/Li	Dryas/Grass/Lichen	0
W-Bt-D/Li	Willow-Shrub Birch-Dryas/Lichen	8
W-Bt-D/G	Willow-Shrub Birch-Dryas/Grass	0
S-G/Li	Sedge-Grass/Lichen	5
W-D/S-G	Willow-Dryas/Sedge-Grass	4
W-Bt/Li (Subalpine)	Willow-Shrub Birch/Lichen	27
W-Bt/D	Willow-Shrub Birch/Dryas	7
W-Bt/G-S	Willow-Shrub Birch/Grass-Sedge	8
W-Bt/G-S/Bm	Willow-Shrub Birch/Grass-Sedge/Bog moss	9
W-Bt	Willow-Shrub Birch	0
Fa/W-Bt	Alpine Fir/Willow Shrub-Birch	5
Fa/Fm	Alpine Fir/Feathermoss	7
Fa/Lg/Bm	Alpine Fir/Labrador Tea/Bog moss	1
Sw/Fm	White Spruce/Feathermoss	20
Sw/Eq	White Spruce/Equisetum	0
Sw/Lb	White Spruce/Twinflower	1
Sw/Bm	White Spruce/Bog moss	8
Sw/En	White Spruce/Mossberry	2
Sw/W-Bt	White Spruce/Willow-Shrub Birch	3
Sw/Li	White Spruce/Lichen	2
Sw/Ki	White Spruce/Kinnikinnick	4
Sw/Sc	White Spruce/Soapberry	2
Sw/Nd	White Spruce/Nudum	2
Sw/G	White Spruce/Grass	0
Sw/D	White Spruce/Dryas	0
Sb/Bm	Black Spruce/Bog moss	7
Sb/Lg	Black Spruce/Labrador Tea	3
Sb/Sp	Black Spruce/Sphagnum	1
Pl/W-Bt	Lodgepole Pine/Willow-Shrub Birch	8
Pl/Li	Lodgepole Pine/Lichen	1
Pl/G	Lodgepole Pine/Grass	3
Pl/Ki	Lodgepole Pine/Kinnikinnick	13
Pl/Nd	Lodgepole Pine/Nudum	3
Pl/Fm	Lodgepole Pine/Feathermoss	3
Pl/Al	Lodgepole Pine/Alder	1
Pt/Ki	Aspen/Kinnikinnick	2
Pt/Sc-Ki	Aspen/Soapberry-Kinnikinnick	21
Pt/G	Aspen/Grass	3
Pt/W-Bt	Aspen/Willow-Shrub Birch	0
Pt/Ve	Aspen/Highbush Cranberry	0
W/S	Willow/Sedge	5
W/Eq	Willow/Horsetail	1
W/W	Willow/Willow	1
W/Ki	Willow/Kinnikinnick	4

DESIGNATOR	VEGETATION COMMUNITY	FREQUENCY OF SITES
W-Bt/Bm	Willow-Shrub Birch/Bog moss	15
W-Bt/Li (Boreal)	Willow-Shrub Birch/Lichen	3
W-Bt/G	Willow-Shrub Birch/Grass	2
Sg/G	Sage/Grass	4
S/Wm	Sedge/Wetland Moss	11
G/Li	Grass/Lichen	7
	TOTAL Number of Sites	247

APPENDIX L

Vascular Plants of the Southern Lakes Study Area*

LYCOPODIACEAE - Club Moss Family

Lycopodium alpinum L.
Lycopodium annotinum L. subsp. *annotinum*
Lycopodium annotinum L. subsp. *pungens* (La Phyl.) Hult.
Lycopodium clavatum L. subsp. *monostachyon* (Grev. and Hook.) Sel.
Lycopodium complanatum L.
Lycopodium selago L.

EQUISETACEAE - Horsetail Family

Equisetum arvense L.
Equisetum fluviatile L. ampl. Ehrh,
Equisetum pratense L.
Equisetum scirpoides Michx.
Equisetum sylvaticum L.
Equisetum variegatum Schleich.

PINACEAE - Pine Family

Abies lasiocarpa (Hook.) Nutt. - Alpine Fir
Picea glauca (Moench) Voss - White Spruce
Picea mariana (Mill.) Britt. Sterns Pogg. - Black Spruce
Pinus contorta Dougl. ex Loud. - Lodgepole Pine

CUPRESSACEAE - Cypress Family

Juniperus communis L. subsp. *nana* (Willd.) Syme - Common Mountain Juniper
Juniperus horizontalis Moench - Creeping Savin

GRAMINEAE - Grass Family

Agropyron boreale (Turez.) Drobov
Agropyron violaceum (Hornem.) Lange
Alopecurus aequalis Sobol.
Arctagrostis latifolia (R. Br.) Griseb.
Beckmannia syzigachne (Steud.) Fern.
Bromus Pumpellianus Scribn.
Calamogrostis canadensis (Michx.) Beauv.
Calamagrostis neglecta (Ehrh.) Gaertn., Mey. and Schreb.
Calamagrostis purpurascens R. Br.
Calamagrostis lapponica (Wahlenb.) Hartm.
Deschampsia beringensis Hult

Deschampsia caespitosa (L.) Beauv.
Festuca altaica Trin.
Festuca rubra L. coll.
Hierochloë alpina (Sw.) Roem. and Schult.
Hordeum jubatum L.
Phleum commutatum Gandoger var.americanum (Fourn.)Hult.
Poa arctica R. Br.
Poa glauca M. Vahl.
Poa lanata Scribn. and Merr.
Poa scabrella (Thurb.) Benth.
Poa sp.
Trisetum spicatum (L.) Richter

CYPERACEAE - Sedge Family

Carex aquatilis Wahlenb.
Carex atherodes Spreng.
Carex concinna R. Br.
Carex macloviana d'Urv.
Carex microchaeta Holm.
Carex phaeocephala Piper
Carex physocarpa Presl
Carex rostrata Stokes
Carex saxatilis L.
Carex sp.
Eriophorum viridi - carinatum (Engelm.) Fern.

JUNCACEAE - Rush Family

Juncus arcticus Willd.
Juncus sp.
Luzula parviflora (Ehrh.) Desv.

LILIACEAE - Lily Family

Tofieldia glutinosa (Michx.) Pers.
Zygadenus elegans Pursh

SALICACEAE - Willow Family

Populus balsamifera L. - Balsam Poplar
Populus tremuloides Michx. - Aspen
Salix arctica Pall. - Arctic Willow
Salix Barrattiana Hook.
Salix Bebbiana Sarg. - Long Beaked Willow
Salix glauca L. - Blue Green Willow
Salix polaris Wahlenb. - Snow-bed Willow
Salix reticulata L. - Netted Willow

Salix Scouleriana Barratt
Salix sp.

BETULACEAE - Birch Family

Alnus crispa (Ait.) Pursh - Alder
Betula glandulosa Michx. - Shrub Birch
Betula occidentalis Hook.
Betula papyrifera Marsh. - Paper Birch

SANTALACEAE - Sandalwood Family

Geocaulon lividum (Richards.) Fern.

POLYGONACEAE - Buckwheat Family

Oxyria digyna (L.) Hill
Polygonum viviparum L.
Rumex crispus L.

PORTULACACEAE - Purslane Family

Claytonia sarmentosa C.A. Mey.

CARYOPHYLLACEAE - Pink Family

Arenaria capillaris Poir.
Minuartia sp.
Silene acaulis L.
Stellaria longifolia Muhl.
Stellaria monantha Hult.

RANUNCULACEAE - Crowfoot Family

Aconitum delphinifolium DC.
Anemone Drummondii S. Wats.
Anemone multifida Poir.
Anemone narcissiflora L. subsp. *interior* Hult.
Anemone parviflora Michx.
Anemone Richardsonii Hook.
Caltha leptosepala DC.
Delphinium brachycentrum Ledeb.
Delphinium glaucum S. Wats.
Pulsatilla patens (L.) Mill.
Ranunculus sceleratus L.
Ranunculus sp.

CRUCIFERAE - Mustard Family

Arabis Drummondii Gray
Descurainia pinnata (Walt.) Britt.
Draba lanceolata Royle

CRASSULACEAE - Stonecrop Family

Sedum lanceolatum Torr.
Sedum rosea (L.) Scop.

SAXIFRAGACEAE - Saxifrage Family

Parnassia palustris L.
Ribes lacustre (Pers.) Poir.
Ribes oxyacanthoides L.
Ribes triste Pall.
Saxifraga bronchialis L.
Saxifraga oppositifolia L. subsp. *oppositifolia*
Saxifraga reflexa Hook.
Saxifraga tricuspidata Rottb.

ROSACEAE - Rose Family

Dryas intergrifolia M. Vahl.
Dryas octopetala L.
Fragaria virginiana Duchesene subsp. *glauca* (S.Wats.) Staudt.
Potentilla arguta Pursh
Potentilla diversifolia Lehm.
Potentilla fruticosa L.
Potentilla Hookeriana Lehm.
Potentilla hyparctica Malte
Potentilla palustris (L.) Scop.
Potentilla pennsylvanica L.
Potentilla villosa Pall.
Rosa acicularis Lindl.
Rubus acaulis Michx.
Rubus arcticus L.
Rubus chamaemorus L.
Sanguisorba stipulata Raf.

LEGUMINOSAE - Pea Family

Astragalus alpinus L.
Hedysarum alpinum L.
Hedysarum Mackenzii Richards.
Lupinus arcticus S.Wats.
Oxytropis campestris (L.) DC.

Oxytropis Maydelliana Trautv.
Oxytropis nigrescens (Pall.) Fisch.
Oxytropis viscida Nutt.

ELEAGNACEAE - Oleaster Family

Shepherdia canadensis (L.) Nutt.

ONAGRACEAE - Evening Primrose Family

Epilobium angustifolium L.
Epilobium latifolium L.

HALORAGACEAE - Water - Milfoil Family

Hippuris vulgaris L.

CORNACEAE - Dogwood Family

Cornus canadensis L.

PYROLACEAE - Wintergreen Family

Moneses uniflora (L.) Gray.
Pyrola asarifolia Michx. var. *purpurea* (Bunge) Fern.
Pyrola chlorantha Sw.
Pyrola secunda L.

EMPETRACEAE - Crowberry Family

Empetrum nigrum L. subsp. *hermaphroditum* (Lange.) Böcher

ERICACEAE - Heath Family

Arctostaphylos rubra (Rehd. and Wilson) Fern.
Arctostaphylos uva-ursi (L.) Spreng.
Cassiope Mertensiana (Bong.) D. Don
Cassiope tetragona (L.) D. Don
Kalmia polifolia Wang.
Ledum palustre L. subsp. decumbens (Ait.) Hult.
Ledum palustre L. subsp. groenlandicum (Oeder) Hult.
Phyllodoce empetriformis (Sm.) D. Don
Rhododendron lapponicum (L.) Wahlenb.
Vaccinium caespitosum Michx.
Vaccinium uliginosum L.
Vaccinium vitis-idaea L.

PRIMULACEAE - Primrose Family

Dodecatheon frigidum Cham. & Schlect.
Dodecatheon pulchellum (Raf.) Merr. subsp. *pauciflorum* (Greene) Hult.

GENTIANACEAE - Gentian Family

Gentiana glauca Pall.
Gentiana propinqua Richards.

POLEMONIACEAE - Phlox

Polemonium acutiflorum Willd.
Polemonium boreale Adams.
Polemonium pulcherrimum Hook.

BORAGINACEAE - Borage Family

Mertensia paniculata (Ait.) G. Don
Myosotis alpestris F.W. Schmidt

SCROPHULARIACEAE - Figwort Family

Castilleja caudata (Pennell) Rebr.
Pedicularis capitata Adams
Pedicularis labradorica Wirsing
Pedicularis lapponica L.
Pedicularis ornithorhyncha Benth.
Pedicularis sudetica Willd.
Pentstemon Gormani Greene
Pentstemon procerus Dougl.
Veronica Wormskjoldii Roem. and Schult.

LENTIBULARIACEAE - Bladderwort Family

Pinguicula vulgaris L.

PLANTAGINACEAE - Plantain Family

Plantago eriopoda Torr.
Plantago major L.

RUBIACEAE - Madder Family

Galium boreale L.

CAPRIFOLIACEAE - Honeysuckle Family

Linnaea borealis L.
Viburnum edule (Michx.) Raf.

CAMPANULACEAE - Bluebell Family

Campanula lasiocarpa Cham.
Campanula rotundifolia L.

COMPOSITAE - Composite Family

Achillea borealis Bong.
Antennaria lanata (Hook.) Greene
Antennaria monocephala DC.
Antennaria sp.
Arnica cordifolia Hook.
Arnica frigida C.A. Mey.
Artemisia borealis Pall.
Artemisia arctica Less.
Artemisia dracunculus L.
Artemisia frigida Willd.
Artemisia Michauxiana Bess.
Artemisia Tilesii Ledeb.
Aster sibiricus L.
Erigeron compositus Pursh
Petasites frigidus (L.) Franch.
Petasites sagittatus (Banks) Gray
Saussurea angustifolia (Willd.) DC.
Senecio fuscatus (Jord. and Bourr.) Hayek
Senecio lugens Richards.
Senecio triangularis Hook.
Senecio yukonensis Porsild
Solidago decumbens Greene
Solidago multiradiata Ait.

*This does not attempt to be a comprehensive list of vascular species in the Southern Lakes region. These species were found at ground sampling sites in the E.L.S. and/or the Caribou Habitat Study.

Authorities used:

- Hulten, Eric. 1968. Flora of Alaska and Neighbouring Territories, A Manual of the Vascular Plants. Standford University Press.
- Porsild, A.E. and W.J. Cody. 1980. Vascular Plants of the Continental Northwest Territories, Canada. National Museums of Canada.

In cases where specimens were sent to W.J. Cody of the National Herbarium in Ottawa for positive identification, the species names and authorities assigned were incorporated into this list.

APPENDIX M

Bryophytes of the Southern Lakes Study Area[1]

Class Musci (Mosses)

SPHAGNACEAE

Sphagnum riparium Angstr.
Sphagnum rubellum Wils.

DICRANACEAE

Dicranum acutifolium (Lindb. & Arnell) C. Jens. ex Weinm.
Dicranum brevifolium (Lindb.) Lindb.
Dicranum elongatum Schleich. ex Schwaegr.
Dicranum fuscescens Turn.
Dicranum spadiceum Zett.

BRYACEAE

Pohlia nutans (Hedw.) Lindb.

AULACOMNIACEAE

Aulacomnium palustre (Hedw.) Schwaegr.
Aulacomnium turgidum (Wahlenb.) Schwaegr.

MEESIACEAE

Paludella squarrosa (Hedw.) Brid.

AMBLYSTEGIACEAE

Drepanocladus aduncus (Hedw.) Warnst.
Drepanocladus revolvens (Sw.) Warnst.
Drepanocladus uncinatus (Hedw.) Warnst.
Drepanocladus vernicosus (Lindb. ex C. Hartm.) Warnst.
Scorpidium turgescens (T. Jens.) Loeske

BRACHYTHECIACEAE

Brachythecium turgidum
Brachythecium sp. (C. J. Hartm.) Kindb.
Tomenthypnum nitens (Hedw.) Loeske

ENTODONTACEAE

Pleurozium schreberi (Brid.) Mitt.

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[1] Identified by R.R. Ireland, Museum of Natural Sciences, Ottawa. This is not meant to be a comprehensive list of bryophytes in the study area, but rather is a list of those species collected at ground sampling sites.

HYPNACEAE

Ptilidium ciliare (L.) Hampe
Ptilium crista-castrensis (Hedw.) De Not.

RHYTIDIACEAE

Rhytidium rugosum (Hedw.) Kindb.

HYLOCOMIACEAE

Hylocomium splendens (Hedw.) B.S.G.

POLYTRICHACEAE

Polytrichum commune Hedw.
Polytrichum juniperinum Hedw.
Polytrichum strictum Brid.

Class Hepaticae (Liverworts)

JUNGERMANNIACEAE

Barbilophozia hatcheri (Evans) Loeske
Barbilophozia lycopodioides (Wallr.) Loeske

APPENDIX N

Lichens of the Southern Lakes Study Area[1]

Class Ascomycetes

ALECTORIACEAE

Alectoria ochroleuca (Hoffm.)
Bryoria lanestris (Ach.) Brodo & Hawks.

CLADONIACEAE

Cladina arbuscula (Wallr.) Hale & Culb.
Cladina mitis (Sandst.) Hale & Culb.
Cladina rangiferina (L.) Harm.
Cladina ranifacine
Cladina stellaris (Opiz) Brodo
Cladonia amaurocraea (Flk.) Schaer.
Cladonia coccifera (L.) Willd.
Cladonia crispata (Ach.) Flot.
Cladonia ecmocyna (Ach.) Nyl.
Cladonia fimbriata (L.) Fr.
Cladonia minaurocraea
Cladonia ochrocyne
Cladonia phyllophora (Ehrh.) Hoffm.
Cladonia sulphurina (Michx.) Fries
Cladonia uncialis (L.) Wigg.

HYPOGYMNIACEAE

Hypogymnia austerodes (Nyl.) Ras.
Hypogymnia physodes (L.) Nyl.

LECANORACEAE

Lecanora epilorzoni

PARMELIACEAE

Cetraria cucullata (Bell.) Ach.
Cetraria islandica (L.) Ach. spp. islandica
Cetraria laevigata Rass.
Cetraria nivalis (L.) Ach.
Masonhalea richardsonii (Hook. in Richardson) Karnef.
Parmelia ambigue

STEREOCAULACEAE

Stereocaulon paschale (L.) Hoffm.
Stereocaulon tomentosum Fr.

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[1] Identified by P.Y. Wong, National Museums of Canada, Ottawa. This list is not comprehensive of the Southern Lakes Area, but is rather a list of species collected at ground sampling sites.

USNEACEAE

Dactylina arctica (Hook.) Nyl.
Dactylina beringica Thoms. & Bird
Usnea sorediifera (Arn.) Lynge

PELTIGERACEAE

Nephroma arcticum (L.) Torss.
Nephroma expallidum (Nyl.) Nyl.
Peltigera aphthosa (L.) Willd.
Peltigera malacea (Ach.) Funck

APPENDIX O

Study Area Streams with Watershed Codes

60 Yukon River Tributaries

60	0000	000	000		Yukon River
	8550				Laberge Creek
	8920				Unnamed Creek "Nine-Mile Creek" (left bank)
	8960				Unnamed Creek (left bank)
		010			Porter Creek
	9040				Croucher Creek
		010			Unnamed Creek (right bank)
	9060				McIntrye Creek
		010			Unnamed Creek (left bank, from Louise Lake)
			100		Fish Creek
	9100				Long Lake
	9190				Ice Lake
	9200				Hidden Lakes
	9210				Unnamed Creek (from "McLean Lake")
	9240				Unnamed Creek "Mill Creek" (left bank)
	9250				Chadburn Lake
	9350				Wolf Creek
		010			Cowley Creek
			020		Unnamed Creek (right bank, from Kookatsoon Lake)
			040		Cowley Lake
		020			Unnamed Creek (right bank, from "Rush Lake")
	9600				Unnamed Creek (left bank, from Mt. Lorne)
	9717				McClintock River
		070			Michie Creek
			030		Byng Creek
			150		Ike Brook
		120			Cap Creek
			170		Unnamed Creek (right bank)
60	9780				Grayling Creek
		010			Caribou Creek
	9790				Elbow Creek
	9839				Unnamed Creek (right bank)
	9850				Monkey Creek
		050			Unnamed Creek (right bank)
	9868				Judas Creek
		030			Unnamed Creek (left bank)
	9874				Kenny Creek

67 Teslin River Tributaries

67	0000	000	000	000	Teslin River
	3600				Mary River
	3800				Swift River
		100			Unnamed Creek (right bank, from Rosy Lake)
	4200				Hundred Mile Creek

67 Teslin River Tributaries (Cont'd)

4400				Dave Creek
4600				Wilson Creek
	020			Unnamed Creek (right bank)
5000				Squanga Creek
	040			Unnamed Creek (right bank, from "Muriel Lake" and "Bishop Lake")
	070			Seaforth Creek
		015		Salmo Lake
		030		Teenah Creek
			180	Unnamed Creek (right bank)
	080			Unnamed Creek (right bank)
		030		Unnamed Creek (right bank)
5010				Muskrat Creek
	010			Unnamed Creek (left bank)
5100				Meadow Creek "4 Mile Creek"
	020			Unnamed Creek (left bank)
	040			Unnamed Creek (left bank, from "Haircut Lake")
	060			Unnamed Creek "Beaver Creek" (right bank)
5250				Unnamed Creek (left bank)
	010			Little Teslin Lake
5370				Unnamed Creek (left bank)
5500				Brooks Brook
5670				Unnamed Creek (left bank)
5900				Deadman Creek "Deadmans Creek"
6200				Lone Tree Creek
6300				Ten Mile Creek
6390				Sterlin Creek
6400				Fat Creek
	080			Unnamed Creek (left bank)
	130			Grouse Creek "McCleary Creek"
6600				Fox Creek
7100				Nisutlin River
	010			Unnamed Creek (right bank)
	030			Wolf Creek
		040		Unnamed Creek (left bank)
		060		Caribou Creek "Hassell Creek" "Canyon Creek"
	040			Unnamed Creek (left bank)
	130			Unnamed Creek (left bank)
	150			Unnamed Creek (left bank)
	380			Sidney Creek
		020		Murphy Creek
8500				Morley River
	020			Hays Creek
	040			Strawberry Creek
	090			Unnamed Creek (left bank)
	150			Unnamed Creek (left bank)

68 Takhini River Tributaries

68	0000	000	000	000	Takhini River
	1300				Flat Creek
		070			Unnamed Creek (left bank)
	1320				Unnamed Creek (right bank)
	1400				Unnamed Creek (right bank)
	2000				Little River
		020			Unnamed Creek (left bank)
		170			Unnamed Creek (left bank)
		190			Unnamed Creek (right bank)
	2300				Thirty-seven Mile Creek
	2700				Ibex River
		020			Arkell Creek
			030		Unnamed Creek (left bank)
			100		Unnamed Creek (right bank)
			240		Unnamed Creek (right bank)
		100			Unnamed Creek (right bank, from Scout Lake)
		140			Jackson Creek
		320			Unnamed Creek (right bank)
	3000				Unnamed Creek (right bank)
	4700				Primrose River
		200			Rose Creek
			050		Unnamed Creek (left bank)
			080		Unnamed Creek (right bank)
			160		Unnamed Creek (left bank)
			170		Unnamed Creek (right bank)
		220			Unnamed Creek (left bank)
			050		Unnamed Creek (left bank)

69 Tagish River Tributaries

69	0000	000	000	000	Tagish River
	0100				Tagish Creek
	0300				Pennycook Creek
	0500				Unnamed Creek (east shore)
	1400				Unnamed Creek "Nares Creek" "Grayling Creek" (from Chootla Lake, Crag Lake)
		090			Unnamed Creek (right bank)
		130			Twelve Mile Creek
	1500				Watson River
		010			Unnamed Creek (left bank)
		020			Unnamed Creek (left bank from Spirit Lake)
		030			Wabona Creek
		060			Unnamed Creek (left bank)
			010		Lewes Creek
				020	Unnamed Creek (right bank)
		070			Lewes Lake
		090			Bear Creek
		130			Thompson Creek
			070		Morrison Creek
		150			Two Horse Creek

69 Tagish River Tributaries (Cont'd)

		050	Friday Creek
	420		Unnamed Creek (left bank)
		030	Unnamed Creek (left bank)
		040	Unnamed Creek (right bank)
	550		Unnamed Creek (right bank)
2000			Wheaton River
	110		Unnamed Creek (left bank, from Annie Lake)
		080	Perkins Creek
	170		Partridge Creek
	180		Dawson Charlie Creek
	190		Becker Creek
		120	Unnamed Creek (left bank)
	250		Summit Creek
		030	Towle Creek
	270		Butte Creek
		050	Unnamed Creek (right bank)
	300		Fenwick Creek
		020	Unnamed Creek (left bank)
		010	Unnamed Creek (left bank)
	310		Berney Creek
		010	Skukum Creek
	360		Boudette Creek
		030	Unnamed Creek (left bank)
	390		Unnamed Creek (right bank)
2100			Millhaven Creek
2300			Unnamed Creek (north shore west arm)
2900			MacAuley Creek
	040		Crozier Creek
3000			Partridge River
	020		Lemieux Creek
3300			Unnamed Creek (from Munroe Lake)
	010		Latrielle Creek
3900			Unnamed Creek (east shore Bennett Lake)
4000			Dundalk Creek
	030		Unnamed Creek (right bank)
4050			Knob Creek
	040		Unnamed Creek (right bank)
4230			Unnamed Creek (opposite Wheaton mouth)
4300			McDonald Creek
4500			Unnamed Creek "Tank Creek" (opposite Watson mouth)
	020		Unnamed Creek (left bank)
5000			Big Thing Creek
5200			Pooly Creek
5220			Unnamed Creek (west shore of Windy Arm)
5600			Lime Creek
6200			Unnamed Creek (west shore of Taku Arm)
6220			Unnamed Creek (east shore of Taku Arm)
6450			Unnamed Creek (east shore of Taku Arm)
9900			Atlin River
	050		Lubbock River

69 Tagish River Tributaries (Cont'd)

020		Unnamed Creek (left bank)
030		Unnamed Creek (right bank)
041		Unnamed Lake "Marcella Lake"
	010	Unnamed Lake "Colleen Lake"
	020	Unnamed Lake
050		Tarfu Creek
	060	Happy Valley
070		Snafu Creek
160		Haunka Creek
200		Unnamed Creek (right bank)
	010	Unnamed Creek (left bank)
	030	Mosquito Creek
	040	Moose Brook
210		Little Atlin Creek
220		Unnamed Creek (north end of Little Atlin Lake)
	030	Unnamed Lake "Judas Lake" "Moose Lake" "Easy Lake"

APPENDIX P

Products List of the Southern Lakes Study Area

Resource Inventory - Southern Lakes Report, by Dan Davies, Catherine Kennedy, Karen McKenna. February, 1983.

Aquatics Resources Inventory, Southern Lakes Project Map Folio, by Dan Davies and Sue Ellenton. 1980.

Soils/Surficial Geology Resources Inventory, Southern Lakes Project, Map Folio, by Steve Morison, Karen McKenna, Susan Davies. 1983.

Vegetation Resources Inventory, Southern Lakes Project, Map Folio, by Christine Boyd, Catherine Kennedy and Robert Bowlby (consultant). 1983.

The Southern Lakes baseline maps have been entered into an interactive graphics computer system at Canada Geographical Information System (C.G.I.S.), Lands Directorate, in Ottawa.

Graphic Computer Maps (in preparation), Canada Geographical Information System (C.G.I.S.), Lands Directorate, Ottawa.

- Permafrost Distribution
- Burn Areas
- Soil Capability for Agriculture
- Campground Suitability
- Areas of Channel Instability
- Fish Species Sensitivity
- Standing Commercial Timber
- Land Capability for Forestry
- Soil Suitability for Construction Materials

Aquatics data base entered into British Columbia Systems Corporation (BCSC).

BCSC Reports (Computer)

- Watershed Dictionary (Alphabetical and Numerical)
- Reach Files
- Point Files
- Fish Files
- Features Report

Lab data and related field information registered with The Canada Soil Information System (CanSIS) Land Resource Research Institute, Research Branch, Agriculture Canada, Ottawa.

Resource Inventory - Southern Lakes Field Form Documentation, Soils/Surficial Geology. Prepared by Karen McKenna, Susan Davies. March, 1983.

Archaeological Survey in the Southern Lakes District, Yukon Territory, 1980. Final Report. 94pp. plus appendices ms on file Archaeological Survey of Canada, Ottawa and the Territorial Archives, Whitehorse. Greer, Sheila C.

1982 Research Proposal: Late Prehistoric Land-Use Patterns in the Southern Lakes District, Yukon Territory. 15pp. ms on file, Archaeological Survey of Canada, Ottawa.

"Parasites of Fish from Four Yukon Lakes", C.D. Shepard, Helmco Research. 1981.

Preliminary Interpretive Maps - Whitehorse 1050•NW - Southern Lakes, Map Folio.

Soil Capability for Agriculture
Campground Suitability
Hazard Map
Suitability for Construction Materials
Suitability for Highways and Roads
Suitability for Hiking and Equestrian Trails
Suitability for Septic Systems